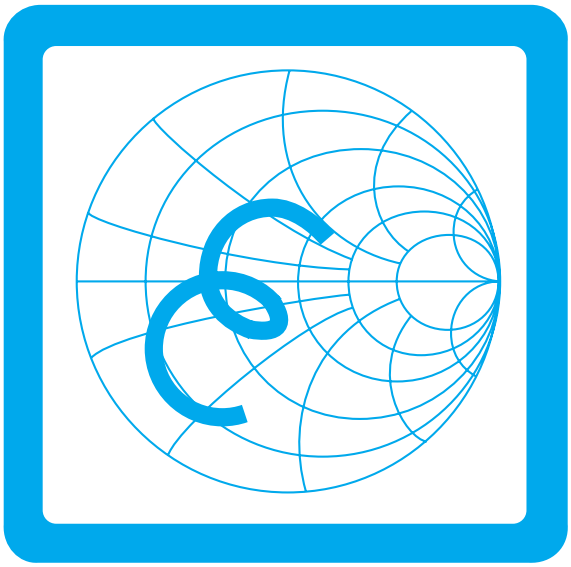

NETWORK ANALYZERS

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VECTOR NETWORK MEASUREMENT SYSTEMS

MS4622A/B, MS4623A/B

10 MHz to 3 GHz **10 MHz to 6 GHz**

Innovative Manufacturing Solutions for Measuring S-Parameters, NF, P_{1dB}, IMD, and 3-Port Devices

GPIB

Anritsu has a new family of RF Vector Network Measurement Systems, the MS462XA and MS462XB. Code named Scorpion®, the MS462XX line is much more capable than traditional VNAs. With Scorpion's all new measurement options of vector error-corrected Noise Figure, Intermodulation Distortion, Third Measurement Port, and Harmonics, they create a total test solution. And, when you add the standard benefits of outstanding dynamic range and blazing fast measurement speed, you have a truly innovative solution for a manufacturing test environment! Scorpion's optional AutoCal® feature also provides a capability for achieving fast, accurate, and highly repeatable calibrations without the need for an external controller. By using AutoCal® standard connector types or test port cable converters, you can calibrate directly using Type N, K, 3.5 mm, or SMA connectors. Planned upgrades include adapter characterization with the ability to calibrate using 7/16 or TNC type connectors.

Performance

- **Measurement speed**

With point-to-point, fully phase-locked, fully error-corrected sweep speeds as fast as 150 µsec per point, Scorpion® provides the real-time measurement speed required for your production line. Its Tune Mode feature offers the advantage of maintaining a full 12-term calibration while simultaneously optimizing sweep speed for the S-parameter measurements of interest.

- **Dynamic range**

The MS462XX family provides system dynamic range of up to 125 dB. This dynamic range, coupled with an impressive measurement speed, lets you tune 2- or 3-port devices with nulls as low as 100 dB in real time.

- **Test sequencing / keyboard control**

For ease in automating repetitive set-ups, calibrations, measurements, or other functions, Scorpion® implements a Test Sequencing (Macro) capability. It can internally store up to seven different sequences and run them directly from either the front panel or an external AT-style keyboard. You can use the supplied keyboard-function-key overlay to fully operate the unit without touching its front panel.

- **3-Port measurements**

Improve and simplify calibrations and measurements of 3-port devices by adding the optional third measurement port. The Scorpion® family is capable of fully calibrating 3-port measurement setups. This maximizes the accuracy of 3-port measurements without the need for making time-consuming and error-inducing connector disconnects and reconnects.

- **Second internal source with third measurement port**

Fully characterize any device that requires two independent sources. Also the testing of passive 3-port devices such as duplexers, circulators/isolators, and mixers – as well as two-tone intermodulation testing of active devices – is greatly simplified using this option.

- **Pass/fail testing**

Evaluate test data using single and segmented limit lines. Create upper and lower trace boundaries of go/no-go testing.

- **Marker functions**

Use up to 12 independent markers to collect data at points of interest, to set boundaries for a marker sweep, or to automatically calculate characteristics such as 3 dB bandwidth, shape factor, and Q.

For product ordering information, see pages 4 – 10

Performance and functions

• Vector error-corrected noise figure measurements

The MS4622B and MS4623B Vector Network Measurement Systems deliver the industry's first ever capability for making vector error-corrected noise figure measurements on active devices in today's hottest market – wireless communications. The Noise Figure options, 4 and 4B, covering the frequency ranges of 50 MHz to 3 GHz and 50 MHz to 6 GHz respectively, give you the functionality for making noise figure measurements much more accurately than has ever before been possible. This option allows for making S-parameter measurements and noise figure measurements with a single test connection. The measurement setup can be configured to make measurements with the noise source set in either an internal or an external mode. In the external mode, the noise source is connected directly to the DUT similar to traditional scalar noise figure measurements. In the internal mode, the noise source is connected to the VNA rear panel and internally routed to port 1. Therefore, when a 12-term calibration is applied concurrently with the noise figure calibration, you can make vector error-corrected noise figure measurements.

• AutoCal®

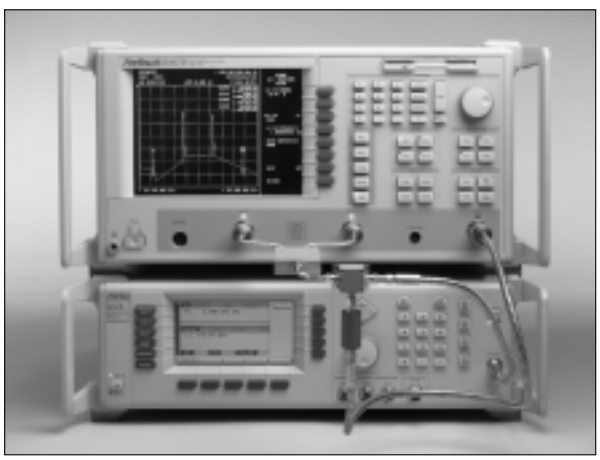
One source of potential errors and inaccuracies in any measurement system is its calibration. A great deal of time can be wasted in a busy manufacturing environment trying to verify calibration accuracy, especially when multiple shifts run on several different test stations for the same product line. For this situation, you need a calibration system in place that offers the highest possible degree of assurance that every station on every shift is calibrated for identical results. With the Anritsu AutoCal® automatic calibrator, you get just that. Simply connect a serial cable between the AutoCal® and the rear panel of the VNA and you're ready to go. If adapters become necessary, AutoCal® can handle them with its revolutionary approach to adapter removal. This approach avoids the necessity of multiple calibrations commonly used in adapter removal calibrations. By using the AutoCal® adapter characterization process, you can calibrate in a SMA, Type N, 3.5mm, TNC, or 7/16 environment with confidence.

• Built-in third measurement port and second internal source

Some of today's most demanding VNA measurements involve the characterization and tuning of multiple port devices such as duplexers, combiners, couplers, etc. In a traditional 2-port VNA, the full characterization and tuning of such devices presents significant challenges in terms of measurement speed, calibration, and the switching of input signals and measurement ports. With the addition of the third measurement port, the simplicity and speed with which these devices can be tested is greatly enhanced. The MS4622B and MS4623B network analyzers not only offer the option of adding a third measurement port, they also offer the industry's first ever second internal source. This second source is completely independent from the main source that switches between ports 1 and 2. By the addition of this second source, the potential now exists for replacing the signal generators and spectrum analyzers currently needed to characterize the non-linear effects that occur when multiple tones are simultaneously present in the pass-band of an active device.

• Mixer measurements

Scorpion can also accurately characterize your mixers and other frequency-translating devices (FTDs) for isolation, match, conversion loss, noise figure and frequency translated group delay (FTGD). Without changing cables or instruments, Scorpion can make all these measurements quickly, easily and accurately. Add an external synthesizer and Scorpion can easily orchestrate swept frequency and swept power mixer IMD measurements. You no longer have to buy and integrate five separate instruments to perform these everyday measurements. With the integrated measurement flexibility of Scorpion, you can design and manufacture all of your passive, active, and frequency translating devices using a single instrument.



Specifications

Test port characteristics	Standard connector type	N female				
	Optional connector types	3.5 mm female, 3.5 mm male, GPC-7, N male				
	Measurement port characteristics	Connector	Frequency (MHz)	Directivity (dB)	Source match (dB)	Load match (dB)
		3.5 mm	10 to 1000*1,2 1000 to 3000*1,2 3000 to 6000*1,2 10 to 1000*1,3 1000 to 3000*1,3 3000 to 6000*1,3 10 to 1000*4 1000 to 3000*4 3000 to 6000*4	>46 >44 >38 >44 >42 >37 >30 >25 >20	>44 >41 >39 >42 >40 >37 >15 >15 >15	>46 >44 >38 >44 >42 >37 >15 >15 >15
		N-Type	10 to 1000*1,2 1000 to 3000*1,2 3000 to 6000*1,2 10 to 1000*1,3 1000 to 3000*1,3 3000 to 6000*1,3 10 to 1000*4 1000 to 3000*4 3000 to 6000*4	>46 >44 >38 >44 >42 >37 >30 >25 >20	>44 >41 >39 >42 >40 >37 >15 >15 >15	>46 >44 >38 >44 >42 >37 >15 >15 >15
		GPC-7	10 to 1000*1,2 1000 to 3000*1,2 3000 to 6000*1,2 10 to 1000*1,3 1000 to 3000*1,3 3000 to 6000*1,3 10 to 1000*4 1000 to 3000*4 3000 to 6000*4	>46 >44 >38 >44 >42 >37 >30 >25 >20	>44 >41 >39 >42 >40 >37 >15 >15 >15	>46 >44 >38 >44 >42 >37 >15 >15 >15
Source specifications	Frequency range	MS4622A/B, 10 MHz to 3 GHz MS4623A/B, 10 MHz to 6 GHz				
	Frequency resolution	1Hz				
	Frequency stability (with internal time base) – aging	$<5x10^{-6}$ / year				
	Temperature	$<5x10^{-6}$ over +15°C to +50°C				
	Power output range	MS4622A Transmission/Reflection Test Set	+10 to –85 dBm			
		MS4622B Active Reversing Test Set	+10 to –85 dBm			
		MS4622B (Opt 3) w/ 2nd Source, 3rd Test Port & S/A.	+10 to –85 dBm			
		MS4622B (Opt 4) w/ Noise Figure	+7 to –85 dBm			
		MS4622B (Opt 6) w/ 3rd Test Port	+10 to –85 dBm			
		MS4623A Transmission/Reflection Test Set	+10 to –85 dBm			
		MS4623B Active Reversing Test Set	+7 to –85 dBm			
		MS4623B (Opt 3) w/ 2nd Source, 3rd Test Port & S/A	+7 to –85 dBm			
		MS4623B (Opt 4) w/ Noise Figure (3 GHz only)	+5 to –85 dBm			
		MS4623B (Opt 6) w/ 3rd Test Port	+7 to –85 dBm			
	Power control range	≥ 20 dB. The minimum absolute level for power sweep is –15 dBm while the maximum power output for a unit is +10 dBm.				
	Source power level	The source power (dBm) may be set from the front panel menu or via GPIB. Port 1 power level is settable from +10 dBm (on the simpler test sets, ranging to +5 dBm on the most complex) to –15 dBm with 0.01 dB resolution. In addition, the port 1 (& port 3) power may be attenuated in 10 dB steps using the internal 70 dB step attenuator.				
	Power level accuracy	±1 dB (no flat power calibration applied; full-band frequency sweep at –15 dBm, 0 dBm, and maximum rated power)				
	Level test port power	The power at all sweep frequencies is leveled to within ±1dB. Only port 1 and port 3 (if installed) can be externally leveled.				
	Harmonics and spurious	<–30 dBc at maximum rated power				
	Sweep type	Linear, CW, Marker, or N-Discrete point sweep				
	Power sweep range	20 dB (minimum)				
	Source #2 (optional) – Frequency range	10 MHz to 3 GHz (6 GHz)				
	Source #2 (optional) – Frequency resolution	1 Hz				
	Source #2 (optional) – Power level accuracy	±1 dB (no flat power calibration applied; full-band frequency sweep at –15 dBm, 0 dBm & max rated power)				
	Source #2 (optional) – Harmonics and spurious	<–30 dBc at maximum rated power (not applicable in harmonic measurement mode)				
	Source #2 (optional) – Sweep type	Linear, CW, Marker, or N-Discrete point sweep				
	Source #2 (optional) – Power sweep range	20 dB (minimum)				

*1: 12-term error correction applied
*2: Port 1 & Port 2
*3: Optional Port 3 added
*4: Uncorrected performance

Continued on next page

<table>
<tr><td rowspan="3">Receiver specs</td><td>Average noise level</td><td>–100 dBm in 10 Hz IF Bandwidth (< 3 GHz); Typically > –110 dBm in narrowband sweep
–90 dBm in 10 Hz IF Bandwidth (> 3 GHz); Typically > –100 dBm in narrowband sweep</td></tr>
<tr><td>Maximum
input level</td><td>+27 dBm, +20 dBm noise figure mode</td></tr>
<tr><td>Damage
level</td><td>> +30 dBm, > +23 dBm noise figure mode</td></tr>
<tr><td colspan="2">Measurement speed
summary</td><td>Measurement times are measured using a single trace (S_{21}) display and one average. The measurement speeds for the communications band are measured in a 25 MHz band from 824 – 849 MHz. The typical measurement times displayed are as follows:
<table>
<tr><th>Data
points</th><th>IF bandwidth
(Hz)</th><th>10 MHz to 3 GHz
(ms)</th><th>10 MHz to 6 GHz
(ms)</th><th>Communications band
(ms)</th></tr>
<tr><td rowspan="5">51</td><td>30 kHz</td><td>22</td><td>25</td><td>13</td></tr>
<tr><td>10 kHz</td><td>27</td><td>31</td><td>18</td></tr>
<tr><td>3 kHz</td><td>38</td><td>41</td><td>28</td></tr>
<tr><td>1 kHz</td><td>71</td><td>75</td><td>62</td></tr>
<tr><td>300 Hz</td><td>190</td><td>194</td><td>181</td></tr>
<tr><td rowspan="5">101</td><td>30 kHz</td><td>32</td><td>36</td><td>21</td></tr>
<tr><td>10 kHz</td><td>41</td><td>45</td><td>29</td></tr>
<tr><td>3 kHz</td><td>63</td><td>67</td><td>51</td></tr>
<tr><td>1 kHz</td><td>130</td><td>135</td><td>118</td></tr>
<tr><td>300 Hz</td><td>366</td><td>371</td><td>355</td></tr>
<tr><td rowspan="5">201</td><td>30 kHz</td><td>49</td><td>54</td><td>37</td></tr>
<tr><td>10 kHz</td><td>68</td><td>74</td><td>52</td></tr>
<tr><td>3 kHz</td><td>112</td><td>118</td><td>96</td></tr>
<tr><td>1 kHz</td><td>247</td><td>253</td><td>231</td></tr>
<tr><td>300 Hz</td><td>717</td><td>723</td><td>701</td></tr>
<tr><td rowspan="5">401</td><td>30 kHz</td><td>85</td><td>92</td><td>69</td></tr>
<tr><td>10 kHz</td><td>122</td><td>130</td><td>97</td></tr>
<tr><td>3 kHz</td><td>212</td><td>220</td><td>186</td></tr>
<tr><td>1 kHz</td><td>481</td><td>489</td><td>456</td></tr>
<tr><td>300 Hz</td><td>1418</td><td>1426</td><td>1393</td></tr>
<tr><td rowspan="5">801</td><td>30 kHz</td><td>154</td><td>166</td><td>132</td></tr>
<tr><td>10 kHz</td><td>230</td><td>242</td><td>190</td></tr>
<tr><td>3 kHz</td><td>408</td><td>420</td><td>367</td></tr>
<tr><td>1 kHz</td><td>947</td><td>959</td><td>907</td></tr>
<tr><td>300 Hz</td><td>2819</td><td>2831</td><td>2777</td></tr>
</table></td></tr>
<tr><td rowspan="19">Measurement capabilities</td><td>Parameters</td><td>S_{11}, S_{21}, S_{22}, S_{12}, S_{33}, S_{23}, S_{32}, S_{13}, S_{31}, Harmonics, Noise Figure, Intermodulation Distortion (IMD), and user-defined combinations of a_1, a_2, a_3, b_1, b_2, and b_3.</td></tr>
<tr><td>Measurement frequency range</td><td>Frequency range of measurement can be narrowed within the calibration range without recalibration.
CW mode permits single frequency measurements, also without recalibration. In addition, the system accepts N discrete frequency points where 2 <N <1601.</td></tr>
<tr><td>Domains</td><td>Frequency Domain, CW Draw, and optional High Speed Time (Distance) Domain</td></tr>
<tr><td>Formats</td><td>Log Magnitude, Phase, Log Magnitude & Phase, Smith Chart (Impedance), Smith Chart (Admittance), Linear Polar, Log Polar, Group Delay, Linear Magnitude, Linear Magnitude and Phase, Real, Imaginary, Real & Imaginary, SWR, and Power</td></tr>
<tr><td>Data points</td><td>1601 maximum. Number of data points can be switched to a value of 801, 401, 201, 101, 51, 15, or 3 points without recalibration (if 1601 points were used in the calibration). In addition, the system accepts an arbitrary set of N discrete data points where 2 ≤N ≤1601. CW mode permits selection of a single data point without recalibration.</td></tr>
<tr><td>Reference delay</td><td>Can be entered in time or in distance (when the dielectric constant is entered). Automatic reference delay feature adds the correct electrical length compensation at the push of a button. Software compensation for the electrical length difference between reference and test is always accurate and stable since measurement frequencies are always synthesized. In addition, the system compensates reference phase delay for dispersive transmission media such as microstrip.</td></tr>
<tr><td>Alternate sweep</td><td>Allows the ability to decouple channel 1 and 2 from channel 3 and 4 for the following parameters: correction type, start and stop frequencies, number of data points, markers, sweep time, averaging, smoothing, and IF bandwidth.</td></tr>
<tr><td>Markers</td><td>Twelve independent markers can be used to read out simultaneous measurement data. In alternate sweep mode there are sets of markers for each frequency sweep. In delta reference marker mode, any one marker can be selected as the reference for the other eleven. Markers can be directed automatically to the minimum or maximum of a data trace.</td></tr>
<tr><td>Enhanced markers</td><td>Marker search for a level or bandwidth, displaying an active marker for each channel, and discrete or continuous (interpolated) markers. Identifies the X dB bandwidth of amplifiers, filters, and other frequency sensitive devices.</td></tr>
<tr><td>Marker sweep</td><td>Sweeps upward in frequency between any two markers. Recalibration is not required during the marker sweep.</td></tr>
<tr><td>Limit lines</td><td>Either single or segmented limit lines can be displayed. Two limit lines are available for each trace.</td></tr>
<tr><td>Single limit readouts</td><td>Interpolation algorithm determines the exact intersection frequencies of data traces and limit lines.</td></tr>
<tr><td>Segmented limit lines</td><td>A total of 20 segments (10 upper and 10 lower) can be generated per data trace. Complete segmented traces can be offset in both frequency and amplitude.</td></tr>
<tr><td>Test limits</td><td>Both single and segmented limits can be used for PASS/FAIL testing. PASS or FAIL status is indicated on the display after each sweep. In addition, PASS/FAIL status is output through the rear panel I/O connector as selectable TTL levels (PASS=0V, FAIL=+5V, or PASS=+5V, FAIL=0V).</td></tr>
<tr><td>Tune mode</td><td>Tune Mode optimizes sweep speed in tuning applications by updating forward S-parameters more frequently than reverse ones. This mode lets users select the ratio of forward sweeps to reverse sweeps after a full 12-term calibration. The ratio of forward sweeps to reverse sweeps can be set anywhere between 1:1 to 10,000:1.</td></tr>
<tr><td>Power sweep measurements</td><td>Both Swept Power Gain Compression and Swept Frequency Gain Compression modes are available.</td></tr>
<tr><td>Sequencing</td><td>Seven measurement sequences can be created, stored, edited, and run from the front panel. Sequences can include front-panel functions as well as user-definable control statements. Sequences can be run from either the unit front panel, via GPIB, or from an AT-style keyboard plugged into the front panel.</td></tr>
<tr><td>Harmonic measurement</td><td>Measurement/display of fundamental, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, & 9th harmonic</td></tr>
</table>

Continued on next page

Display capabilities	Display channels		Four, each of which can display any S-parameter or user-defined parameter in any format with up to two traces per channel for a maximum of eight traces simultaneously. Each channel is also capable of displaying harmonics, noise figure, intermodulation distortion, or time domain trace. A single channel, two channels (1 and 3, or 2 and 4), or all four channels can be displayed simultaneously. Channels 1 and 3, or channels 2 and 4, can be overlaid for rectilinear graph types.
	Trace overlay		Displays two data traces on the active channel's graticule simultaneously. The overlaid trace is displayed in yellow and the primary trace is displayed in red.
	Trace memory		A separate memory for each channel can be used to store measurement data for later display or subtraction, addition, multiplication or division with current measurement data.
	Blank frequency information		Blanking function removes all references to displayed frequencies on the LCD. Frequency blanking can only be restored through a system reset or GPIB command.
Measurement enhancements	Data averaging		Averaging of 1 to 4096 averages can be selected. The data averaging function is performed at each data point during the frequency sweep. Averaging can be toggled on or off via the front panel; a front-panel LED indicates that the data averaging function is enabled.
	IF bandwidth		Soft Key selection of IF bandwidth (30 kHz, 10 kHz, 3 kHz, 1 kHz, 300 Hz, 100 Hz, 30 Hz, 10 Hz)
	Trace smoothing		Computes an average over a percentage range of the data trace. The percentage of trace to be smoothed can be selected from 0 to 20% of trace.
	Group delay characteristics	Group delay	Group delay is measured by computing the phase change in degrees across a frequency step by applying the formula: $Tg = \frac{-1/360\ d(phase)}{d(frequency)}$
		Aperture	Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range without recalibration. The frequency width of the aperture and the percent of the frequency range are displayed automatically.
		Range	The maximum delay range is limited to measuring no more than ±180° of phase change within the aperture set by the number of frequency points. A frequency step size of 100 kHz corresponds to 10 microseconds.
		Measurement repeatability (sweep to sweep)	For continuous measurement of a through connection, RSS fluctuations due to phase and FM noise are: $\frac{1.41\ \{(Phase\ Noise)^2 + (Tg \times Residual\ FM\ Noise)^2\}^.5}{360\ (Aperture\ in\ Hz)}$
		Accuracy	Error in $Tg = \frac{\frac{Error\ in\ phase}{360} + (Tg \times Aperature\ Freq.\ Error\ (Hz))}{Aperture}$
		Frequency Translating Group Delay (FTGD)	Allows the measurement of group delay of mixers and other translating devices by analyzing the phase shift experienced by a modulated signal (generated internally). The above Group Delay equation applies, except that the phase change is measured across the modulating bandwidth of the test signal instead of across frequency points. The aperture is fixed at about 900 kHz and the range is limited to about 1 µs. The use of angle modulation keeps the measurement relatively immune from compression and other non-linearities.
	LRL/LRM calibration capability		The LRL calibration technique uses the characteristic impedance of a length of transmission line as the calibration standard. A full LRL calibration consists merely of two transmission line measurements, a high reflection measurement, and an isolation measurement. The LRM calibration technique is a variation of the LRL technique that utilizes a precision termination rather that a second length of transmission line. A third optional standard, either Line or Match may be measured in order to extend the frequency range of the calibration. This extended calibration is achieved by mathematically concatenating either two LRL, two LRM, or one LRL and one LRM calibration(s). Using these techniques, full 12-term error correction can be performed on the MS462XX VNA.
	Dispersion compensation		Selectable as Coaxial (non-dispersive), Waveguide, or Microstrip (dispersive)
	Reference plane		Selectable as Middle of line 1 or Ends of line 1
	Corrected impedance		Determined by Calibration Standards
	AutoCal®		The Scorpion™ family will incorporate internal control of the 3658X-series AutoCal® modules.
Hard copy	Printer		Scorpion™ supports the HP 2225C InkJet, HP QuietJet, HP DeskJet, HP LaserJet II, III, IV, & V Series, and Epson compatible printers with parallel (Centronics) interfaces. They are also compatible with the ANRITSU "CAP3700" program (outputs bitmap file over GPIB) and provide bitmap output over front panel to disk.
	GPIB plotters		Scorpion™ supports the HP Models 7440A, 7470A, and 7475A and Tektronix Model HC100 plotters.
Storage	Internal memory		Ten front panel states (setup/calibration) can be stored and recalled from nonvolatile memory locations. The current front panel setup is automatically stored in nonvolatile memory at instrument powerdown. When power is applied, the instrument returns to its last front-panel setup. The system will be able to exchange two stored calibrations in <0.5 s.
	Internal nonvolatile memory		Used to store and recall measurement and calibration data and frontpanel setups. All files are MS-DOS compatible.
	Internal floppy disk drive		A 3.5 inch diskette drive with 1.44 Mb formatted capacity is used to load measurement programs and to store and recall measurement and calibration data and front-panel setups.
	Measurement data		102.8 kb per 1601 point S-parameter data file
	Calibration data		187.3 kb per 1601 point S-parameter data file (12-term cal plus setup)
	Trace memory file		12.8 kb per 1601 point channel
GPIB	GPIB interfaces		2 ports
	System GPIB (IEEE-488.2)		Connects to an external controller for use in remote programming of the network analyzer. Address can be set from the front panel and can range from 1 to 30.
	Dedicated GPIB		Connects to external peripherals for network analyzer controlled operations (e.g. GPIB plotters, frequency counters, frequency synthesizers, and power meters).

Continued on next page

General	Power requirements	85-240 V, 48-63 Hz, 540 VA maximum
	Dimensions	222H x 425W x 450D mm (8.75 x 16.75 x 17.75 in)
	Weight	16 kg (35 lb)
Environmental	Storage temperature range	–40°C to +75°C.
	Operating temperature range	0°C to +50°C (specifications apply at 23°C ±3 °C).
	Relative humidity	5% to 95% at +40°C.
EMC	Meets the emmissions and immunity requirements of:	EMC Directive - 89/336/EEC
		EN50081-1:1992
		CISPR-11:1990/EN55011:1991 Group 1 Class A
		IMMUNITY Standard IEC 1000-4-2:1995/prEN50082-1:1995 - 4kV CD, 8kV AD IEC 1000-4-3:1995/ENV50140:1994 - 3V/m IEC 1000-4-4:1995/prEN50082-1:1995 -500V SL; 1000V PL IEC 1000-4-5:1995/prEN50082-1:1995 - 2kV L-E, 1kV L-L IEC 1000-4-6:1995/ENV50141:1994 IEC 1000-4-8:1995/prEN50082-1:1995 IEC 1000-4-11:1995/prEN50082-1:1995
	Safety	Meets safety requirements of Low Voltage/Safety Standard 72/23/EEC - EN61010-1:1993

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
MS4622A	10MHz – 3GHz transmission/reflection
MS4622B	10MHz – 3GHz active reversing
MS4623A	10MHz – 6GHz transmission/reflection
MS4623B	10MHz – 6GHz active reversing
	Options
Option 1	Rack mount kit with slides
Option 2	Time domain
Option 3A	2nd internal source (3 GHz source) + 3rd port
Option 3B	2nd internal source (6 GHz source) + 3rd port
Option 4*1	Noise figure 50 MHz to 3 GHz (only for B models)
Option 4B*1	Noise figure 50 MHz to 6 GHz (only for B models)
Option 5	Frequency translation group delay
Option 6*2	3rd test port (B models; for use with external synthesizer)
Option 7	T/R step attenuator (only for A models, standard on B)
Option 8	Harmonic measurement
Option 10	AutoCal® control
Option 11*3	Test Port connector
Option 13	Intermodulation distortion
	AutoCal®
36581NNF/1	AutoCal®, Type N, 10 MHz to 6 GHz
36581KKF/1	AutoCal®, Type K, 10 MHz to 6 GHz
	Noise sources
NC346A	5 dB ENR noise source (3.5 mm)
NC346B	15 dB ENR noise source (3.5 mm)

Model/Order No.	Name
	Calibration kits
3750LF	SMA/3.5 mm RF Cal Kit ≤6 GHz
3751LF	GPC-7 RF Cal Kit ≤6 GHz
3753LF	50 Ohm, Type N, RF Cal Kit ≤6 GHz
	Verification kits
3663LF	Type N verification kit
3666LF	SMA/3.5 mm verification kit
3667LF	GPC-7 verification kit
	Accessories
15LL50-0.3A	3.5 mm Male-Male Cable, 30 cm
15LL50-0.6A	3.5 mm Male-Male Cable, 60 cm
15LLF50-0.3A	3.5 mm Male-Female Cable, 30 cm
15LLF50-0.6A	3.5 mm Male-Female Cable, 60 cm
15NN50-0.3B	Type N Male-Male Cable, 30 cm
15NN50-0.6B	Type N Male-Male Cable, 60 cm
15NNF50-0.3B	Type N Male-Female Cable, 30 cm
15NNF50-0.6B	Type N Male-Female Cable, 60 cm

∗1: Does not include noise source
∗2: Port 3 is a receiving port only, unless using an external synthesizer.
∗3: Standard connector is N-female, no cost option for 3.5 mm (male), 3.5mm (female), N-male, or GPC-7

VECTOR NETWORK MEASUREMENT SYSTEM / DIRECT-ACCESS RECEIVER

MS4622C, MS4623C

10 MHZ to 3 GHz **10 MHz to 6 GHz**

For Measuring Antennas, Frequency Conversion, and Multiple-Output Devices

GPIB

The MS462XC series of RF vector network analyzers are configured as direct-access receivers for antenna, frequency conversion, and multiple output device measurements. The MS462XC offers ultimate flexibility to meet most receiver measurement needs while maintaining the ability to measure all four S parameters with the addition of a reflectometer setup at the front end of the receiver.
The MS462XC series offers two wide-band RF models covering the 10 MHz to 3 GHz or 6 GHz ranges, MS4622C, and MS4623C, respectively.

Applications

• Mixers
Mixers are integral components of most measurement systems. Mixer measurements are complicated by the fact that a LO is required and multiple frequencies are involved in the complete measurement of a mixer. In addition the mixer is non-linear so power levels must be carefully considered, and in many instances non-linear effects such as compression and intermodulation distortion must be measured. The MS462XC has many features that simplify mixer measurements. The MS462XC can include two built in sources, to provide both the LO and RF signal required by the mixer – the system automatically tunes the receiver to the appropriate IF frequency. The unit can control additional external sources as required for intermodulation measurements. The setup of the sources is obviously quite important in a mixer measurement. The Mixer device type simplifies this task somewhat. It allows the quick selection of which source is to be the DUT LO. It allows simple selection of a fixed LO or fixed IF measurement scenario (and specifying that LO or IF frequency). And, it informs the receiver of what kind of DUT conversion to expect (up conversion |RF+LO|, down conversion |RF-LO|, or no conversions might be used for a quick leakage measurement). Activating the mixer device type also performs the important function of turning on both internal sources for front panel access (usually using ports 1 and 3 driving, port 2 being the receive port). Two ports are not allowed to drive simultaneously during normal S-parameter measurements.

• Antennas
Far-field measurements are enhanced with the speed of taking data over GPIB, using fast CW mode. Rates of 1 ms/data point can be achieved using internal triggering, 1.3 ms/point with external triggering, and 1.6 ms/point with GPIB triggering.

For product ordering information, see pages 4 – 10

Specifications

General measurement and enhancement display capabilities are the same as those for the MS4622A/B, MS4623A/B.

Number of channels	Four measurement channels
Operating port power (A1, A2, B1 and B2)	–5 dBm for 0.1 dB compression
Maximum port power for no damage	+20 dBm
Noise floor	–100 dBm@10 Hz IF bandwidth (<3 GHz), typically >–120 dBm in narrowband sweep; –100 dBm@10 Hz IF bandwidth (>3 GHz), typically >–110 dBm in narrowband sweep
System dynamic range	97 dB
Power output range (ports 1, 2 and 3)	MS4622C: +10 to –85 dBm MS4623C: +7 to –85 dBm
Source match (RF1, RF2 and RF3)	–15 dB (uncorrected)
Port match (A1, A2, B1 and B2)	–12 dB (uncorrected)
Frequency range	MS4622C: 10 MHz to 3 GHz MS4623C: 10 MHz to 6 GHz
2nd internal source	Optional
Intermodulation Distortion	Optional
IMD (3rd order) dynamic range	70 dB with 10 Hz IF bandwidth @ 300 kHz tone separation and @ –20 dBm tone levels
IMD accuracy	±1 dB @ > –60 dBm levels
Power measurement accuracy	±1 dB without flat power calibration ±0.1 dB with flat power calibration
Full reversing transfer switch	Provided

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Mainframe
MS4622C	10 MHz to 3 GHz direct receiver access
MS4623C	10 MHz to 6 GHz direct receiver access
	Options
Option 1	Rack mount kit with slides
Option 2	Time domain
Option 3C	2nd internal source (3 GHz source) + 3rd port
Option 3D	2nd internal source (3 GHz source) + 3rd port
Option 5	Frequency translated group delay
Option 6	3rd test port (only for B and C models)
Option 7	T/R step attenuator (only for A models, standard on B)
Option 8*1	Harmonic measurement
Option 10	AutoCal® control
Option 11*2	Test Port connector
Option 13	Intermodulation distortion

∗1: Subject to frequency range limitations imposed by test set.
∗2: Standard connector is N-female, no cost option for 3.5 mm (male), 3.5mm (female), N-male, or GPC-7

POWER AMPLIFIER TEST SYSTEM (PATS)

ME7840A

800 to 2400 MHz, 100 Watts

Easy-to-Use System for Power Amplifier Design and Manufacturing

GPIB

PATS is a flexible, easy-to-use system for power amplifier design and manufacturing. It allows real-time, simultaneous tuning of various amplifier parameters, including IMD and hot S_{22} in both swept-frequency and swept-power modes. Adjacent Channel Power Ratio (ACPR) shows the performance of your PA under real-world modulated conditions and is available with swept power mode. The following table summarizes the PATS measurement capability between 800 and 2400 MHz for applications up to 100 Watts.

Measurement capabilities:

Measurements	CW	Swept Frequency (as fast as 150 µsecs/pt)	Swept Power (as fast as 150 µsecs/pt)
ACPR	√		√ *
S-Parameters Hot S_{22}	√	√	√
IMD, TOI (two-tone): 3rd, 5th, 7th, & 9th	√	√	√
Gain Compression: P_1 dB AM/PM	√ √	√	√ √
Harmonics: Magnitude Phase	√	√ √	√
Power Added Efficiency (PAE)	√	√	√
Drain Current	√	√	√

* Swept power speed is related to external source

PATS consists of three distinct parts: The MS462xC Vector Network Measurement System, the MS4782D Test Set, and the Scorpion PA Navigator.

- **MS462xC Vector Network Measurement System**

The MS462xC is the Direct Receiver Access (DRA) configuration for the MS462xx family of Vector Network Measurement Systems (VNMS). The MS462xC series is available in two wide-band RF models covering the 10 MHz to 3 GHz or 6 GHz range (MS4622C and MS4623C respectively).

- **MS4782D Test Set**

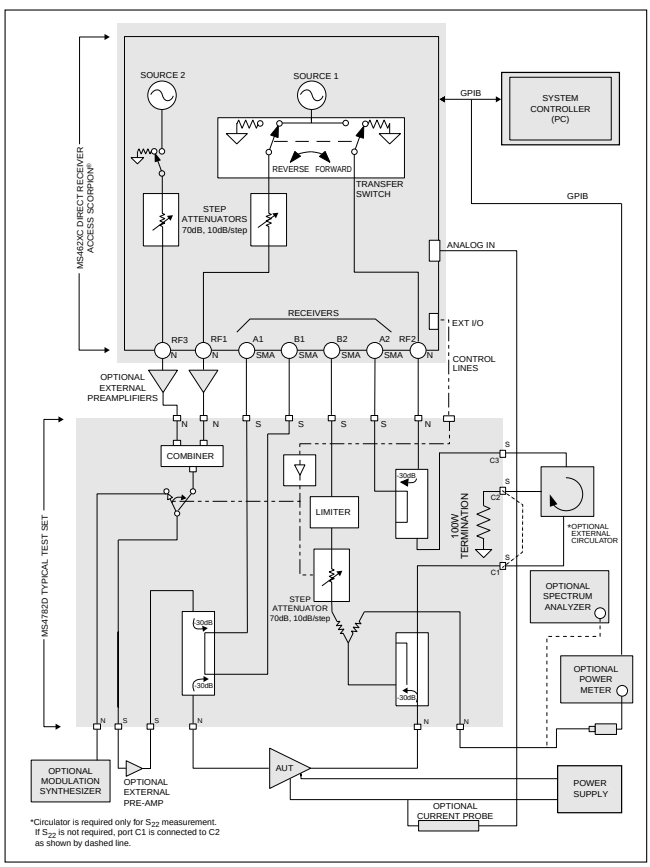
The MS4782D Test Set provides the necessary hardware to interface between your power amplifier and the VNMS.

- **Scorpion PA Navigator**

The Scorpion PA Navigator is installed on your computer to orchestrate the PATS measurements. The computer should be a Pentium II at 200 MHz or equivalent system with a GPIB Card (computer not included).

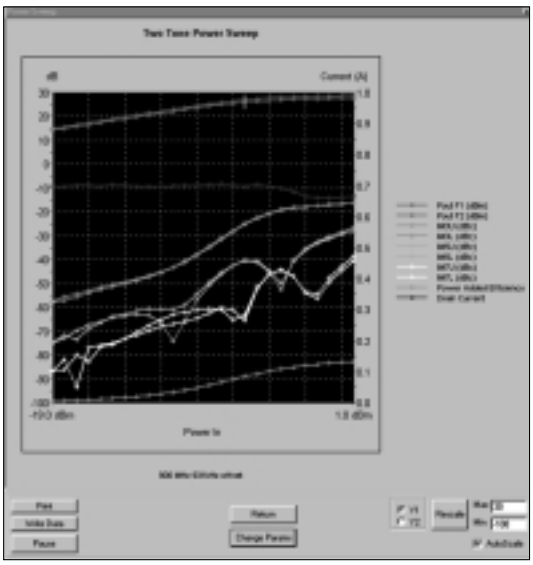
PATS Block Diagram

The following block diagram depicts the standard MS4782D Test Set design. Anritsu can configure and optimize a custom test set for your specific requirements.



For product ordering information, see pages 4 – 10

PATS Software Results
With frequency sweeps as fast as 150 µs/point and power sweeps as fast as 150 µs/point, you can quickly, thoroughly, and accurately characterize your power amplifiers in real-time.
Simultaneously overlay measurements in both frequency and power and see the results of over 250 datapoints updated twice per second.



Specifications

Characteristic	Value	Notes
Amplifier Under Test Power Output	100W max	Without Hot S_{22} provision (Contact Anritsu for custom designs for higher power)
Bandwidth through Test Set	800 MHz – 2.4 GHZ	Without S_{22} provision (Contact Anritsu for custom designs for different frequency ranges)
Amplifier Under Test Input Power range available from PATS	–85 dBm to +10 dBm	This value is for each tone, at combiner input. Provision for preamplifiers provided for greater levels
IMD (3rd order) Dynamic Range	70 dB min	With 10 Hz IF bandwidth @ 300 kHz tone separation and –20 dBm tone levels
IMD Accuracy	±1 dB max	@ >–60 dBc levels
Port Power Accuracy	±0.1 dB typical	With flat power calibration
	±1 dB max	Without flat power calibration
Dynamic Range	80 dB min	Over-all system including Test Set
Port Match (test ports 1 & 2)	40 dB min	Corrected value
Port Match (test ports 1 & 2)	13 dB min	Uncorrected value
Directivity	40 dB	800 MHz – 2.4 GHz, Corrected value

Ordering information

Please specify model/order number, name, and quantity when ordering. Anritsu can configure and optimize a custom test set for your specific requirements. The following information represents the standard configuration and options.

Model/Order No.	Name
	Main frame
ME7840A	PATS, 800 to 2400 MHz, 100 Watts
MS4623C*1,2	Scorpion®, DRA configuration, 10 MHz to 6 GHz
MS4600/3D	Scorpion® optional 6 GHz internal source with 3rd test port
MS4600/8	Scorpion® optional harmonic measurement application
MS4600/13	Scorpion® optional intermodulation distortion application
MS4782D	PATS Test Set (100 Watts, 800 – 2400 MHz)*3
43425	Accessories and interconnect kit
	Scorpion PA Navigator
ME7840/1	Replace MS4623C with MS4622C (3 GHz option)
ME7840/2	Replace MS4782D test set with MS4782A
ME7840/3	Delete Test Set
	Circulators
	Circulators may be required for measurements of Hot S_{22}:
1000-50	Circulator, 800 – 1000 MHz, 20 dB min, 50 Watts Max AUT Power
1000-52	Circulator, 1.8 – 2.5 GHz, 20 dB min, 50 Watts Max AUT Power, (connecting cable(s) not included)
1000-53	Circulator, 1.8 – 2.5 GHz, 22 dB min, 79 Watts Max AUT Power
	Note: All circulators have 3 SMA female connectors.
	Current Probes
	Current Probes are required for drain current and Power Added Efficiency (PAE) calculations:
2000-1067	Current Probe Max current: 100mV/A:10A, 10mV/A:100A Accuracy (at lesser current range setting): 3% of reading ±50mA
2000-1085	Current Probe Max current: 1mV/mA:1A, 10mV/A:80A Accuracy (at lesser current range setting): 2% of reading ±5mA
	Calibration kits
3750LF	SMA/3.5 mm RF Cal Kit (6 GHz)
3753LF	Type N RF Cal Kit (6 GHz)
	AutoCal®
36581NNF/1	AutoCal, Type N, 10 MHz to 6 GHz
36581KKF/1	AutoCal, Type K, 10 MHz to 6 GHz
	Economy cables
15LL50-0.3A	3.5 mm Male-Male Cable, 30 cm
15LL50-0.6A	3.5 mm Male-Male Cable, 60 cm
15LLF50-0.3A	3.5 mm Male-Female Cable, 30 cm
15LLF50-0.6A	3.5 mm Male-Female Cable, 60 cm
15NN50-0.3B	Type N Male-Male Cable, 30 cm
15NN50-0.6B	Type N Male-Male Cable, 60 cm
15NNF50-0.3B	Type N Male-Female Cable, 30 cm
15NNF50-0.6B	Type N Male-Female Cable, 60 cm

∗1: ME7840A standard connector type is N-female.
∗2: Scorpion® DRA rear panel Reference Channel Connectors a1, a2, b1, and b2 are SMA-female connectors.
∗3: Special test sets can be configured for other power levels and frequency ranges.

VECTOR NETWORK ANALYZERS
37100C, 37200C, 37300C Series
22.5 MHz to 65 GHz

For Fast and Accurate S-Parameter Measurements

GPIB

The 37200C and 37300C series microwave vector network analyzers (VNAs) are high performance tools designed to make fast and accurate S-parameter measurements across the 22.5 MHz to 65 GHz range. These network analyzers integrate a synthesized source, S-parameter test set, and tuned receiver into a single compact package that is ideal for benchtop testing.
Code named Lightning, the 37200C and 37300C offer new levels of measurement capabilities to speed manufacturing test and increase throughput. Choose the instrument model and options that best suit your application and budget.
The 37200C series is designed for passive device measurements, while the 37300C series adds active device measurement capabilities. The 37217C/37317C is an economical choice for lower frequency component testing up to 8.6 GHz. Higher frequency solutions to 13.5, 20, 40, 50, and 65 GHz are available in microwave models 37225C/37325C, 37247C/37347C, 37269C/37369C, 37277C/37377C, and 37297C/37397C, respectively.
The 37100C series microwave vector network analyzers are configured as direct-access receivers for antenna, frequency conversion, and multiple output device measurements. The 37100C offers ultimate flexibility to meet most receiver measurement needs while maintaining the ability to measure all four S parameters with the addition of a reflectometer setup at the front end of the receiver.
The 37100C series offers two wide-band microwave models covering the 22.5 MHz to 20 GHz or 40 GHz ranges, 37147C, and 37169C, respectively.

Features

● Next generation VNA technology
The 37100C/37200C/37300C series incorporates a higher speed processor and faster power sweep capability.

● High speed data transfer and control
For maximum efficiency, dual GPIB ports are standard on every 37100C/37200C/37300C series VNA. High-speed transfers across the analyzer's IEEE 488.2 GPIB bus minimize data collection times. The second GPIB port is dedicated to control of peripheral devices such as printers, plotters, power meters, and frequency synthesizers. The 37100C/37200C/37300C series maximizes throughput by combining fast, error-corrected sweeps with high-speed data transfers. Measurement throughput for the 37100C/37200C/37300C series ranks as the fastest of any microwave analyzer in the industry.

● Compact size
The 37200C/37300C series analyzers integrate a fast sweeping synthesized source, auto-reversing S-parameter test set, and four-channel receiver into a single compact package. The 37100C series analyzers integrate a fast sweeping synthesized source and four-channel receiver into a single compact package and provides direct access to all four receiver samplers via the front panel. Components within the analyzer have been integrated to reduce cost and weight and improve the instrument's long-term reliability. Despite its small size, the 37100C/37200C/37300C series analyzers rival the performance normally found in larger, more expensive vector systems.

● Built-in mass storage
Testing devices with multiple setups is now easier. A built-in hard disk drive rapidly stores and recalls frequently used front panel setups and calibrations. Store your complete test setup including limit lines and frequency markers. Create descriptive file names to assist multiple users or device types. The high storage capability of the internal hard disk means there is space for literally hundreds of calibrations, front panel setups, and data traces. In secure environments, the internal hard disk can be removed and either an external drive on the SCSI port or the internal 1.44 MB floppy drive can be used for uploading proprietary setups.

● Fast synthesized sweeps
Measurement update rates of less than 2 ms per point are possible with the 37100C/37200C/37300C series analyzers. Each data point is fully phase-locked and vector-error-corrected for optimum accuracy. Realize near real-time updates with the instrument's tune mode.
The internal source frequency resolution of 1 kHz satisfies most wide- and narrow-band requirements. Devices requiring more frequency definition can be evaluated with 1 Hz frequency resolution (Option 10A).

● Time domain analysis
Analyze impedance discontinuities as a function of time or distance with the 37100C/37200C/37300C's high-speed time domain (Option 2A). Isolate individual reflections in time and evaluate their effects in the frequency domain. Remove the effects of device packages and fixturing with time domain gating to see the actual performance of your designs. Use the independent display channels to view the response of your designs before, during, and after time domain processing. The software provides four different windowing functions to optimize

For product ordering information, see pages 4 – 10

dynamic range and resolution. The exclusive phasor impulse mode will show you the true impedance characteristics of mismatches in waveguide, microstrip, and other band-limited media.

● Multiple source control
Conveniently test mixers and multipliers through the 37100C/37200C/37300C's multiple source control. Separately control the frequency of two sources and a receiver without the need for an external controller. Independently specify the sweep ranges and output powers of the sources and the sweep range of the receiver to accommodate testing of frequency translation devices.

● LabVIEW® compatibility
Standard with every 37100C/37200C/37300C series analyzer is National Instruments LabVIEW® instrument driver. Create custom test programs (virtual instruments) in less time with LabVIEW®'s graphical programming environment. Take advantage of the network analyzer's high data throughput for tuning operations. Fast data transfers over GPIB permit near realtime updates on your PC's display. Customize programs to automatically display, test, and document measurement results. Reuse virtual instruments in other test routines to minimize program development time. LabVIEW® gives you full access to more than 900 mnemonics in the 37100C/37200C/37300C analyzer's command set for complete automated data collection and analysis.

● Internally controlled AutoCal®
One source of potential errors and inaccuracies in any network analyzer system is the calibration of that system. The Anritsu AutoCal automatic calibrator is designed to speed and simplify the calibration of your 37200C/37300C VNA. Using the built-in software support and an AutoCal module connected to the serial port on the rear panel of the instrument, you are ready to make fast, accurate, and repeatable calibrations.

● Three-year factory warranty
All 37100C/37200C/37300C series VNAs are backed with a no-questions-asked three-year warranty.

● Upgradeability
The 37100C/37200C/37300C series analyzers are designed to accommodate higher frequency ranges and more powerful features as your requirements grow. Any 37100C/37200C/37300C series VNA can be upgraded to any other model in the instrument family, or any other series, to fit your changing requirements. Contact Anritsu Customer Service to request an upgrade and an Anritsu service engineer will install the added capability and verify your system's total performance. Upgradeability is a cost-effective approach to satisfying today's production needs while providing the flexibility to meet tomorrow's demands. System software upgrades are as easy as inserting new discs into the instrument's floppy drive.

Applications

● Filters
Let the analyzer's wide dynamic range show you filter rejection and input match on the same display. Overlay traces and tune for optimum transmission and group delay responses without reduction in sweep speed.
Further speed improvements are possible using the instrument's tune mode. This unique feature helps users optimize sweep times in one direction for better hand-to-eye tuning while maintaining a 12-term corrected S-parameter display. Anritsu's tune mode maximizes sweep speed and accuracy, simultaneously, by allowing you to choose when reverse parameters are updated.
Automatically locate filter center frequency, 3 dB bandwidth, max/min insertion loss, 0 dB points, Q, and shape factor. Instantly measure passband phase distortions with Anritsu's automatic reference plane extension capability. A single key press quickly identifies filter non-linear responses.

● Amplifiers (available on 37300C series only)
Easily measure amplifier gain compression vs. input power or frequency. Power meter assisted flat output power calibration provides capability to measure power in dBm. A 1 watt, 70 dB (60 dB on >40 GHz models) step attenuator in the port 1 path, and a 40 dB step attenuator in the port 2 path, coupled with 20 dB ALC range, give complete control to characterize virtually any amplifier. This range is reduced to 12 dB at frequencies >50 GHz. Internal bias tees simplify DC biasing of your active designs. A front panel loop allows external amplifier insertion, increasing port 1 power up to 1 watt for high input power amplifiers.

● Mixers
Mixers as multiport devices take advantage of the multiple source control and set-on receiver mode features.
The 37100C/37200C/37300C can be configured to measure the relative harmonic level of test devices with set-on receiver mode capability. The 37100C/37200C/37300C's unique phase locking scheme allows it to operate as a tuned receiver by locking all of its local oscillators to its internal crystal reference oscillator. Set-on receiver mode capability significantly increases the versatility of the 37100C/37200C/37300C VNA in applications that check for harmonics, intermodulation products, and signals of known frequency.
Multiple source control capability allows a user to independently control the frequencies of two sources and the receiver without the need for an external controller. The frequency ranges and output powers of the two sources may be specified. A frequency sweep may be comprised of up to five separate bands, each with independent source and receiver settings, for convenient testing of frequency translation devices such as mixers. Up to five sub-bands may be tested in one sweep. This feature enables users to easily test mixers, up/down converters, multipliers, and other frequency conversion devices.

● Microstrip devices
The 37200C/37300C series offers complete substrate measurement solutions for both microstrip and coplanar waveguide (CPW) designs. The 37200C/37300C series analyzers accommodate the model 3680 series Universal Test Fixtures (UTF), calibration kits, and verification kits. Guaranteed system specifications provide assurance that your test results are accurate and verifiable.
Completely characterize connectorless devices with the 37200C/37300C's Line-Reflect-Line (LRL) and Line-Reflect-Match (LRM) calibration capability. The four channel design provides true LRL/LRM error-correction giving you the highest performance available for in-fixture measurements. Highly reflective devices, along with well matched ones are measured with the same degree of ease. Automatic dispersion compensation improves measurement accuracy to help you determine phase distortions in all your microstrip designs. The result is quality measurements you can count on for your connectorless devices.

● Antennas
Far field measurements are enhanced with the speed of taking data over GPIB, using the 37100C in fast CW mode. Rates of 0.8 ms/point can be achieved using internal triggering, 1.2 ms/point with external triggering, and 1.5 ms/point with GPIB triggering.
For near field measurements, internal buffer data collection is provided to allow saving active channel measurement data from multiple sweeps without having to synchronize and collect data at the end of each sweep. The 37100C can store up to 50,000 data point measurements, each consisting of two real and imaginary IEEE 754 4-byte floating point numbers.

● Multiport devices
The 37100C offers direct access to all four samplers. Flat test port power calibration using a power meter allows source calibration and characterization of all four receiver channels. Ratioed measurements can then be performed on any combination of the four channels. Absolute dBm measurements can also be made through the user-defined parameter feature.

Specifications

Measurement capabilities	Number of channels	Four measurement channels
	Parameters	S_{11}, S_{21}, S_{12}, S_{22}; or user defined, complex input and output impedance; complex input or output admittance; complex forward and reverse transmission
	Domains	Frequency domain, CW draw, and optional high speed time domain (Option 2A)
	Formats	Log magnitude, phase, log magnitude and phase, Smith chart (impedance), Smith chart (admittance), linear polar, log polar, group delay, linear magnitude, linear magnitude and phase, real, imaginary, real and imaginary, and SWR
	Data points	1601 maximum. System also accepts an arbitrary set of N discrete data points where $2 \leq N \leq 1601$. CW mode permits selection of a single point.
	Reference delay	Can be entered in time or in distance. Automatic reference delay adds the correct electrical length compensation at the push of a button. Software compensation for the electrical length difference between the reference and test is accurate and stable since measurement frequencies are always synthesized.
	Markers	Six independent markers can be used to read out measurement data. In delta-reference mode, any one marker can be selected as the reference for the other five. Markers can automatically find critical filter parameters i.e. 3 dB bandwidth, loss, center frequency, shape factor and Q.
	Marker sweep	Sweeps upward in frequency between any two markers. Recalibration is not required during the marker sweep.
	Limits	Two limit lines per data trace to indicate test limits. Limits can be either single or segmented limits for testing devices pass-fail.
	Measurement dynamic range	Table 1 gives receiver dynamic range as the ratio of maximum signal level at Port 2 (or individual sampler input) to the noise floor.
	Data averaging	Averaging of 1 to 4096 averages per data point can be selected.
	IF bandwidth	Front panel switch selects four levels of IF bandwidth: 10 kHz, 1 kHz, 100 Hz and 10 Hz
Display capabilities	Display channels	1, 2, 3 or 4 channels can be displayed. Each channel can display any S-parameter or user defined parameter in any format with up to two traces per channel for a maximum of eight traces simultaneously.
	Display type	Color LCD, 8.5" diagonally, VGA display. Color of graticule, trace data and text are user definable.
	Trace overlay	Overlays two traces with the same graticule type on the same display
	Trace memory	A separate memory for each channel can be used to store measurement data for later display or subtraction, addition, multiplication or division.
	Scale resolution	Log mag: 0.001 dB, linear mag: 1 pU Phase: 0.01°, group delay: 0.001 ps Time: 0.001 ms, distance: 0.1 mm SWR: 1 pU Power: 0.05 dB
	Autoscale	Automatically sets resolution and offset to display measurement data on the full display
	Reference position	Settable to any graticule line
	Annotation	Type of measurement, vertical and horizontal scale resolution, start and stop frequencies and reference position
Vector error correction	Error correction models	Full 12-term, one-path two-port, reflection only, transmission response
	LRL/LRM	Line-Reflect-Line and Line-Reflect-Match calibration models are available for coaxial, microstrip and waveguide transmission lines.
Signal source capabilities	Source power level	Source power may be set from the 37100C/37200C/37300C front panel menu. Check table 2 for levels.
	Flat power correction	The 37100C/37200C/37300C corrects for test port power variations using an external power meter. Once the port power has been flattened, the power meter is removed and the signal source power level may be changed within the remaining power adjustment range.
	Multiple source control	Allows a user to separately control the frequency of two sources and receiver without need for an external controller. Source #1: 37200C/37300C internal source, or any 68000C or 69000B synthesizer Source #2: Any 68000C or 69000B synthesizer Receiver: 37200C/37300C internal receiver
	Internal 10 MHz time base stability	Standard With aging: $<1 \times 10^{-6}$/day With temperature: $<1 \times 10^{-6}$ over 15° to 50°C High stability time base (Option 10A) With aging: $<1 \times 10^{-9}$/day With temperature: $<5 \times 10^{-9}$ over 0° to 55°C
Hard copy	Printers	Select full screen, graphical, tabular data, and printer type. Compatible with most HP and Epson printers with a parallel (Centronics) interface
	GPIB plotters	Compatible with most HP and Tektronix plotters
Storage	Internal memory	Ten front panel states (setup) can be stored and recalled from non-volatile memory locations.
	Internal hard disk drive	Used to store and recall setup and calibration files, trace data and tabular data files. All files are MS-DOS compatible.
	Internal floppy disk drive	Stores and recalls setup and calibration files from 3.5 inch 1.44 MB floppy disks. All files are MS-DOS compatible.
Remote programming	Interface	GPIB (IEEE 488.2)
	Addressing	Address can be set from the front panel and can range from 1 to 30.
	Transfer formats	ASCII, 32-bit floating point and 64-bit floating point
	Speed	150 kB/sec
	Interface function codes	SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DT1, DC0, C0
General	Test ports	GPC-7, 3.5 mm, N-type, K, and V connectors supported
	Power requirements	85 to 240 V, 48 to 63 Hz, 540 VA maximum
	Dimensions	432 (W) x 267 (H) x 585 (D) mm (10.5 x 17 x 23 in)
	Mass	27 kg (60 lbs)
	Temperature	0° to 50°C (operate), –40° to 75°C (storage)

For product ordering information, see pages 4 – 10

Table 1a Dynamic range (37100C)

Model	Frequency (GHz)	Max. signal into a_x, b_x (dBm)	Noise floor (dBm)	Receiver dynamic range (dB)	Source power (dBm, typical)
37147C	0.0225 2 20	–18 –12 –12	–122 –106 –103	104 94 91	10 8 5
37169C	0.0225 2 20 40	–18 –12 –12 –15	–122 –106 –103 –100	104 94 91 85	10 8 3 –3

Table 1b Dynamic range (37200C/37300C)

Model	Frequency (GHz)	Max. signal into port 2 (dBm)	Noise floor (dBm)	Receiver dynamic range (dB)	Port 1 power (dBm, typical)	System dynamic range (dB)
37217C	0.0225 2 8.6	+3 +3 +3	–95 –98 –98	98 101 101	0 0 0	95 98 98
37225C	0.04 2 13.5	+20 +3 +3	–70 –98 –98	90 101 101	0 0 0	70 98 98
37247C	0.04 2 20	+20 +3 +3	–70 –98 –96	90 101 99	0 0 0	70 98 96
37269C	0.04 2 20 40	+20 +3 +3 +3	–70 –98 –95 –93	90 101 98 96	0 0 –5 –15	70 98 90 78
37277C	0.04 2 20 40 50	+20 +3 +3 +3 +3	–77 –105 –97 –95 –87	97 108 100 98 90	0 +5 –2 –7 –2	77 110 95 88 85
37297C	0.04 2 20 40 50 65	+20 +3 +3 +3 +3 +3	–77 –105 –97 –95 –87 –77	97 108 100 98 90 80	0 +5 –2 –7 –2 –2	77 110 95 88 85 75
37317C	0.0225 2 8.6	+30 +30 +30	–95 –98 –98	125 128 128	0 0 0	95 98 98
37325C	0.04 2 13.5	+30 +30 +30	–65 –93 –93	95 123 123	+5 +5 +5	70 98 98
37347C	0.04 2 20	+30 +30 +30	–65 –93 –91	95 123 121	+5 +5 +5	70 98 96
37369C	0.04 2 20 40	+30 +30 +30 +30	–65 –93 –90 –83	95 123 120 113	+5 +5 0 –7	70 98 90 76
37377C	0.04 2 20 40 50	+30 +30 +30 +30 +30	–77 –105 –97 –95 –87	107 135 127 125 117	0 +5 –2 –7 –2	77 110 95 88 85
37397C	0.04 2 20 40 50 65	+30 +30 +30 +30 +30 +30	–77 –105 –97 –95 –87 –77	107 135 127 125 117 107	0 +5 –2 –7 –2 –2	77 110 95 88 85 75

Table 2 Power range

Model	Rated power (dBm)	Minimum power (dBm)	Resolution (dB)
37147C	+5	–15	0.05
37169C	–3	–23	
37217C	0	–20	
37225C			
37247C			
37269C	–15	–27	
37277C	–7	–27	
37297C	–7	–19	
37317C	0	–95	
37325C	+5	–90	
37347C			
37369C	–7	–97	
37377C	–7	–87	
37397C	–7	–79	

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
37147C	Direct Access Receiver (22.5 MHz to 20 GHz)
37169C	Direct Access Receiver (22.5 MHz to 40 GHz)
37217C	Vector Network Analyzer (22.5 MHz to 8.6 GHz)
37225C	Vector Network Analyzer (40 MHz to 13.5 GHz)
37247C	Vector Network Analyzer (40 MHz to 20 GHz)
37269C	Vector Network Analyzer (40 MHz to 40 GHz)
37277C	Vector Network Analyzer (40 MHz to 50 GHz)
37297C	Vector Network Analyzer (40 MHz to 65 GHz)
37317C	Vector Network Analyzer (22.5 MHz to 8.6 GHz)
37325C	Vector Network Analyzer (40 MHz to 13.5 GHz)
37347C	Vector Network Analyzer (40 MHz to 20 GHz)
37369C	Vector Network Analyzer (40 MHz to 40 GHz)
37377C	Vector Network Analyzer (40 MHz to 50 GHz)
37397C	Vector Network Analyzer (40 MHz to 65 GHz)
	Options
Option 1	Rack mount kit with slides
Option 2A	High-speed time (distance) domain capability
Option 4	External SCSI-2 hard disk drive compatibility (internal HDD removed)
Option 7A	Replaces universal K connector (standard) with universal GPC-7 (37200C/37300C only)
Option 7N	Replaces universal K connector (standard) with universal N-male (37200C/37300C only)
Option 7NF	Replaces universal K connector (standard) with universal N-female (37200C/37300C only)
Option 7S	Replaces universal K connector (standard) with universal 3.5 mm-male (37200C/37300C only)
Option 7K	Replaces universal V connector (standard) with universal K (m) (37277C/37297C/37377C/37397C models only)
Option 10A	High stability (ovenized) time base and 1 Hz frequency resolution
Option 11	Reference loop extension cables (standard on 37300C series)
Option 12	Rear Panel IF Inputs (for 37x97C and 37x77C only). Required for upgrade to ME7808A Broadband VNA.
	Calibration kits
3650	SMA/3.5 mm Calibration Kit
Option 1	Adds sliding terminations
3651	GPC-7 Calibration Kit
Option 1	Adds sliding terminations
3652	K Connector Calibration Kit
Option 1	Adds sliding terminations
3653	Type N Calibration Kit
3654B	V Connector Calibration Kit with sliding terminations
3750	SMA/3.5 mm Economy Calibration Kit (<8.6 GHz)
3751	GPC-7 Economy Calibration Kit (<8.6 GHz)
3753	Type N Economy Calibration Kit (<8.6 GHz)
36581NNF	AutoCal, N (m) to N (f), 40 MHz to 18 GHz
36581KKF	AutoCal, K (m) to K (f), 40 MHz to 20 GHz
36582KKF	AutoCal, K (m) to K (f), 40 MHz to 40 GHz

∗ Call your Anritsu representative for 50 and 65 GHz upgrades.

Model/Order No.	Name
	Verification kits
3663	Type N Verification Kit
3666	SMA/3.5 mm Verification Kit
3667	GPC-7 Verification Kit
3668	K Connector Verification Kit
3669B	V Connector Verification Kit
	Test port cables
3670A50-1	GPC-7 semi-rigid cable, 1 foot
3670A50-2	GPC-7 semi-rigid cable, 2 foot
3670K50-1	K connector semi-rigid cable, 1 foot
3670K50-2	K connector semi-rigid cable, 2 foot
3670V50-1	V connector semi-rigid cable, 1 foot
3670V50-2	V connector semi-rigid cable, 2 foot
3671A50-1	GPC-7 flexible cables, 25 in. (1 pair)
3671A50-2	GPC-7 flexible cables, 38 in.
3671S50-1	3.5 mm flexible cables, 25 in. (1 pair)
3671S50-2	3.5 mm flexible cables, 38 in.
3671K50-1	K connector flexible cables, 25 in. (1 pair)
3671K50-2	K connector flexible cables, 38 in.
3671V50-3	V connector flexible cable, 25 in. (1 pair)
3671V50-4	V connector flexible cable, 38 in.

For product ordering information, see pages 4 –10

MILLIMETER WAVE VECTOR NETWORK ANALYZER
37000 Family
33 to 140 GHz

High Performance Millimeter Wave Vector Network Analysis

GPIB

The 37000 family millimeter wave vector network analyzer (VNA) extends the exceptional performance of the Lightning VNA family to 140 GHz. This improvement to our original millimeter wave system, based on the 360B VNA, continues our commitment to providing the highest quality microwave and millimeter wave test equipment available while still maintaining an intuitive user interface. The minimum configuration for the millimeter wave VNA has a 37147C VNA, a 3735B Test Set, two synthesized sources, and a pair of millimeter heads.

Features

● Measurement speed and accuracy
The millimeter wave VNA, based on our popular Lightning 37000 platform, offers the fastest measurement speed available in a millimeter wave VNA. Measurement speed of approximately 20 ms per point for an 801 data point sweep means faster tuning and throughput for your millimeter wave devices. The millimeter wave system also offers full auto-reversing, 12-term, error-corrected S-parameter measurements that enable advanced calibration techniques such as Line-Reflect-Line (LRL), Line-Reflect-Match (LRM), and Thru-Reflect-Match (TRM) to be used for maximum accuracy in your on-wafer measurements. For waveguide measurements, the millimeter wave system supports all of the above methods as well as the offset short calibration technique. The 8.5 inch, color liquid crystal display (LCD) allows users to easily view the data traces for all four S-parameters while simultaneously displaying limit lines and trace memory functions. The built-in 3.5 inch MS-DOS® compatible floppy disk drive and internal hard disk drive simplify the procedure to both store and recall calibrations, front panel setups, and measurement data. The versatility of the Lightning platform allows data to be gathered using the *.s2p, *.txt, *.dat, *.bmp, *.hgl, and the *.wmf file format so data can be easily loaded into both circuit simulation and graphics programs.

● The most dynamic range in a millimeter VNA
Increased dynamic range relates directly to increased measurement accuracy and confidence when measuring millimeter wave components and subsystems. To achieve optimum measurement speed and dynamic range for your measurements, the Lightning millimeter wave VNA allows the number of measurement averages and video IF bandwidth to be varied. The Lightning millimeter wave VNA system dynamic range is typically 15 dB better than comparable VNAs, and noise floor specifications are measured with 512 averages not 1024 averages — an important point to consider when making comparisons. Simply stated, the Lightning millimeter wave system provides the best dynamic range with sweep speeds twice as fast as comparable instruments.

● Flexible configuration in waveguide and coax
Our flexible module configurations let you specify the capability of your millimeter wave VNA. We offer two versions of millimeter wave heads that allow you to tailor the Lightning based millimeter system to your exact measurement needs. The 3740A series transmission/reflection modules have simultaneous transmission and reflection capability, while the 3741A series transmission only module is used when reflection measurements are not required. A pair of 3740A modules allows measurement of all four S-parameters. A 3740A transmission/reflection module combined with a 3741A Transmission Only module allows measurement of one-path/two port S-parameters (S_{11} and S_{21}).
A single 3740A transmission/reflection module can be used for S_{11} reflection measurements. The 3740A series also provides the smallest footprint and lightest weight of any millimeter wave test head on the market today. This greatly simplifies your test setup; regardless of whether you are manually adjusting the head position for waveguide measurements or have attached them to a wafer probe station. In order to maximize the flexibility of your VNA, the system architecture provides for a smooth transition between your waveguide and coaxial device measurements. Simply add a coaxial test set to your system and now you have the capabilities to fully characterize your active and passive coaxial devices up to 40 GHz.

● Complete measurement solutions
In addition to the millimeter wave VNA measurement system, Anritsu offers a full line of power meters and synthesized signal generators up to 110 GHz. To complete your millimeter wave measurement setup, Anritsu also offers solutions for waveguide, on-wafer, and even coaxial applications. With our custom design and manufacturing capabilities, we have developed 110 GHz coaxial connectors, couplers, adapters, and even test fixtures for use in your millimeter wave test set-ups.

Specifications

● System performance

Waveguide designation	Q-Band (WR-22)	V-Band (WR-15)	E-Band (WR-12)	Extended E-Band	W-Band (WR-10)	Extended W-Band	F-Band (WR-8)
Frequency range (GHz)	33 to 50	50 to 75	60 to 90	56 to 60 60 to 85 85 to 94	75 to 100 100 to 110	65 to 75 75 to 100 100 to 110	90 to 115 115 to 140
Maximum signal into port 2 (dBm)	+10	+8	+8	+8	+6	+6	+4
Noise floor (dBm)	–93	–90	–90	–85 –90 –76	–90 –90	–90 –89 –87	-88 -87
Receiver dynamic range (dB)*1	103	98	98	93 98 84	96 96	96 95 93	92 91
High level noise (dB, typical)	.02	.05	.06	.08	.06	.08	.08
Power @ DUT (dBm, typical)	+7	+7	+6	+5 +6 +4	+5 +2	–5 +5 +2	–3 –7
System dynamic range (dB)*2	100	97	96	90 96 80	95 92	85 94 89	85 80

*1: “Receiver dynamic range” is defined as the ratio of the maximum signal level at Port 2 for 0.1 dB compression to the system noise floor.
*2: “System dynamic range” is defined as the ratio of the power at Port 1 and the system noise floor (forward measurements only).

● Test port characteristics

	Offset short calibration*1						
Waveguide designation	Q-Band (WR-22)	V-Band (WR-15)	E-Band (WR-12)	Extended E-Band	W-Band (WR-10)	Extended W-Band	F-Band (WR-8)
Frequency (GHz)	33 to 50	50 to 75	60 to 90	56 to 94	75 to 110	65 to 110	90 to 140
Directivity (dB)	>50	>50	>46	>44	>46	>40	>45
Source match (dB)	>45	>37	>36	>33	>36	>30	>34
Load match (dB)	>50	>50	>46	>44	>46	>40	>45
Reflection frequency tracking (dB)	±0.010	±0.030	±0.040	±0.080	±0.040	±0.080	±0.060
Transmission frequency tracking (dB)	±0.010	±0.060	±0.060	±0.1	±0.070	±0.1	±0.1
Isolation (dB)	>100	>90	>90	>80	>90	>80	>80

	LRL calibration*1						
Waveguide designation	Q-Band (WR-22)	V-Band (WR-15)	E-Band (WR-12)	Extended E-Band	W-Band (WR-10)	Extended W-Band	F-Band (WR-8)
Frequency (GHz)	33 to 50	50 to 75	60 to 90	56 to 94	75 to 110	65 to 110	90 to 140
Directivity (dB)	>50	>50	>46	>44	>46	>40	>45
Source match (dB)	>50	>50	>46	>43	>46	>40	>45
Load match (dB)	>50	>50	>46	>44	>46	>40	>45
Reflection frequency tracking (dB)	±0.002	±0.002	±0.002	±0.006	±0.002	±0.006	±0.004
Transmission frequency tracking (dB)	±0.002	±0.002	±0.002	±0.006	±0.002	±0.006	±0.004
Isolation (dB)	>100	>90	>90	>80	>90	>80	>80

*1: At 23 ±3˚C using the offset short calibration method with a sliding load or LRL calibration method (as noted) to achieve 12-term error correction.

For product ordering information, see pages 4 – 10

Ordering information

Please specify model/order number, name and quantity when ordering.

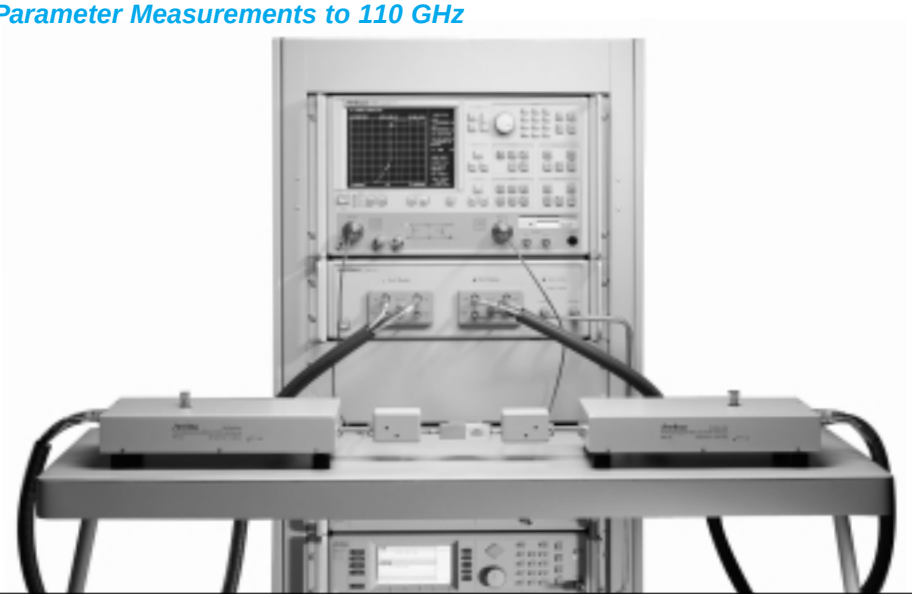
Model/Order No.	Name
	Main frame
37147C	Vector Network Analyzer (22.5 MHz to 20 GHz)
37169C	Vector Network Analyzer (22.5 MHz to 40 GHz)
	Options (for VNA)
Option 1	Rack mounting with track slides
Option 1A	Rack mounting
Option 2A	High-speed time (distance) domain capability
Option 4	External SCSI-2 hard disk drive compatibility
Option 13	Delete internal source
	Millimeter wave test set
3735B	Millimeter wave test set
3700C3	System console
	Options (for test set)
Option 1	Rack mount kit with track slides
Option 1A	Rack mount kit with handles
	Millimeter wave modules*1
3740A-Q	Transmission/reflection module (33 to 50 GHz, WR-22)
3740A-V	Transmission/reflection module (50 to 75 GHz, WR-15)
3740A-E	Transmission/reflection module (60 to 90 GHz, WR-12)
3740A-EE	Transmission/reflection module (56 to 94 GHz, WR-12)
3740A-W	Transmission/reflection module (75 to 110 GHz, WR-10)
3740A-EW	Transmission/reflection module (65 to 110 GHz, WR-10)
3740A-F	Transmission/reflection module (90 to 140 GHz, WR-8)
3741A-Q	Transmission only modules (33 to 50 GHz, WR-22)
3741A-V	Transmission only modules (50 to 75 GHz, WR-15)
3741A-E	Transmission only modules (60 to 90 GHz, WR-12)
3741A-EE	Transmission only modules (56 to 94 GHz, WR-12)
3741A-W	Transmission only modules (75 to 110 GHz, WR-10)
3741A-EW	Transmission only modules (65 to 110 GHz, WR-10)
3741A-F	Transmission only modules (90 to 140 GHz, WR-8)
	Synthesizers*2
MG3692A	Synthesized CW generator, 2 to 20 GHz
MG3693A	Synthesized CW generator, 2 to 30 GHz
MG3694A	Synthesized CW generator, 2 to 40 GHz
	Options (for signal source)
Option 1	Rack mount kit with track slides
Option 1A	Rack mount kit with handles
Option 11	0.1 Hz frequency resolution
Option 14	VNA console mounting
Option 15A*2	High power output
Option 17B	Delete front panel
	Calibration kits*3
3655Q	WR-22 Waveguide (33 to 50 GHz)
Option 1	Adds sliding termination
3655V	WR-15 Waveguide (50 to 75 GHz)
Option 1	Adds sliding termination
3655E	WR-12 Waveguide (60 to 90 GHz)
Option 1	Adds sliding termination
3655W	WR-10 Waveguide (75 to 110 GHz)
Option 1	Adds sliding termination
3655F	WR-8 Waveguide (90 to 140 GHz)
Option 1	Adds sliding termination

∗1: The millimeter wave VNA requires that at least one of the two modules is a transmission/reflection type.
∗2: One of the synthesizers must have Option 15A for millimeter wave operation.
∗3: Consisting of: Short, fixed (2 each)
Shim, 1/4 wavelength and 3/8 wavelength
Termination, fixed (2 each)
Test port section (2 each)

BROADBAND VECTOR NETWORK ANALYZER
ME7808A
40 MHz to 110 GHz

Broadband S-Parameter Measurements to 110 GHz

NEW



CE GPIB

The ME7808A Broadband Vector Network Analyzer (VNA) is a high performance measurement solution that covers 40 MHz to 110 GHz in a single fast sweep. In contrast to the millimeter wave Vector Network Analyzer, the ME7808A is built on the advanced technology of the Lightning 65 GHz VNA, and extends its advanced features and intuitive user interface to 110 GHz.

The configuration for the Broadband VNA consists of:
- Lightning 65 GHz VNA
- Millimeter-Wave Modules (Extended W Band, 65 GHz to 110 GHz)
- Broadband Test Set
- Frequency Sources
- Multiplexing Couplers
- Equipment Console with table

Features

- **Measurement Speed and Accuracy**

The Broadband VNA, based on our popular Lightning 37397C platform, offers the fastest measurement speed available. Measurement speed of approximately 1.5 seconds for a 101 point sweep means faster characterization of your millimeter wave and broad frequency devices. The ME7808A also offers full auto-reversing, 12-term, error-corrected S-parameter measurements with advanced calibration techniques – such as Short-Open-Load-Thru (SOLT), Line-Reflect-Line (LRL), and Line-Reflect-Match (LRM) – ensuring maximum accuracy in your on-wafer measurements. For waveguide measurements, the ME7808A system supports all of the above methods as well as the offset short calibration technique. The 8.5 inch, color liquid crystal display (LCD) allows users to easily view the data traces for all four S-parameters while simultaneously displaying limit lines and trace memory functions. The built-in 3.5 inch MS-DOS ® compatible floppy disk drive and internal hard disk drive simplify the procedure of storing and recalling calibrations, front panel setups, and measurement data. The versatility of the Lightning platform allows data to be gathered using the *.s2p, *.txt, *.dat, *.bmp, *.hgl, and the *.wmf file format so data can be easily loaded into both circuit simulation and graphics programs.

- **Single Pair of Coaxial Test Ports**

The ME7808A Broadband VNA combines the 40 MHz to 65 GHz output from the VNA and the 65 GHz to 110 GHz output from the mmW modules using a unique multiplexing coupler design. The effective system test ports for broadband frequency coverage are two W1 (1.0 mm) coax connectors. The Anritsu W1 connector is compatible with the IEEE standard 1.0 mm connector. This design provides a DC path that permits bias injection from the VNA front panel bias inputs directly to the W1 coax test ports.

- **Three Systems in One**

The Broadband VNA system provides maximum versatility and can be used in any of the following configurations:
1) as a broadband VNA (40 MHz to 110 GHz) with W1 (1.0 mm) connector coaxial interface
2) as a stand-alone 65 GHz VNA with V-connector coaxial interface
3) as a millimeter-wave VNA (65 GHz to 110 GHz) with a WR-10 waveguide connector interface. Additional discrete mmW bands are easily supported by substituting other available mmW modules into the system.

This flexibility in measurement interface allows you to tailor the Broadband VNA to your exact measurement needs. When operating either the 65 GHz or mmW systems independently, higher output power and increased dynamic range are achievable. Wafer probe tips can be connected to any of the three interfaces to make on-wafer measurements.

- **Complete Measurement Solutions**

The Anritsu Broadband VNA is compatible with leading probe stations and probe tips for making on-wafer measurements. On-wafer calibration software such as SussCal from Karl Suss and WinCal from Cascade Microtech have built in drivers for the Anritsu VNA's and therefore can be used with the ME7808A. In addition, Anritsu also offers a complete list of accessories including coaxial calibration kits, waveguide calibration kits, on-wafer calibration substrates, W1 (1mm) coaxial and waveguide to coaxial adapters.

For product ordering information, see pages 4 –10

Specifications

Dynamic range (typical)

	Frequency (GHz)	0.04	2	20	40	50	<65	>65	75	85	100	110
W1 Coaxial Port	Max Signal into Port 2 (dBm)	30	30	30	30	30	30	16	14	13	12	12
	Port 1 Power, Typical (dBm)	-1	3	-7	-14	-10	-12	-14	-10	-11	-9	-11
	Noise Floor (dBm)	-76	-103	-92	-88	-79	-67	-65	-78	-81	-78	-73
	System Dynamic Range (dB)	75	106	85	74	69	55	51	68	70	69	62
	Receiver Dynamic Range (dB)	106	133	122	118	109	97	81	92	94	90	85

	Frequency (GHz)	0.04	2	20	40	50	<65	>65	75	85	100	110
On Wafer	Max Signal into Port 2 (dBm)	30	30	30	30	30	30	18	17	16	16	16
	Port 1 Power, Typical (dBm)	-1	3	-8	-16	-12	-14	-16	-13	-14	-13	-15
	Noise Floor (dBm)	-76	-103	-91	-86	-77	-65	-63	-75	-78	-74	-69
	System Dynamic Range (dB)	75	106	83	70	65	51	47	62	64	61	54
	Receiver Dynamic Range (dB)	106	133	121	116	107	95	81	92	94	90	85

	Frequency (GHz)	0.04	2	20	40	50	65
V Coaxial Port	Max Signal into Port 2 (dBm)	30	30	30	30	30	30
	Port 1 Power, Typical (dBm)	0	5	-2	-7	-2	-2
	Noise Floor (dBm)	-77	-105	-97	-95	-87	-77
	System Dynamic Range (dB)	77	110	95	88	85	75
	Receiver Dynamic Range (dB)	107	135	127	125	117	107

	Frequency (GHz)	65	75	85	100	110
WR-10 Waveguide	Max Signal into Port 2 (dBm)	8	8	8	8	8
	Port 1 Power, Typical (dBm)	-6	-4	-6	-5	-7
	Noise Floor (dBm)	-73	-84	-86	-82	-77
	System Dynamic Range (dB)	67	80	80	77	70
	Receiver Dynamic Range (dB)	81	92	94	90	85

System dynamic range is defined as the ratio of the typical power at Port 1 and the system noise floor.
The noise floor measurement is made using 512 averages in a 100 Hz IF bandwidth, including isolation calibration.

Measurement time for 101 data points (typical)

Frequency Span	40 MHz to 110 GHz
Time (s)	1.5

Measurement time is based on a single 40 MHz to 110 GHz sweep with 10 kHz IF bandwidth (no averages) after full 12-term calibration. Sweep time includes retrace and band switch times.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
ME7808A	Broadband Vector Network Analyzer (includes 3742A-EW*1 millimeter wave modules, broadband test set, frequency sources, multiplexing couplers, and an equipment console for 40 MHz to 110 GHz functionality)
	Options
Option 14	Split-Band (Microwave/mmW) VNA, replaces 65 GHz (37397C) with 50 GHz (37377C) VNA, deletes multiplexing coupler and 65 to 110 GHz mmW modules. Select desired mmW modules separately.
	Optional Millimeter-wave modules
3740A-V	Transmission/Reflection Module, 50 to 75 GHz
3740A-E	Transmission/Reflection Module, 60 to 90 GHz
3740A-EE	Transmission/Reflection Module, 56 to 94 GHz
3740A-EW	Transmission/Reflection Module, 65 to 110 GHz
3740A-W	Transmission/Reflection Module, 75 to 110 GHz
3740A-F	Transmission/Reflection Module, 90 to 140 GHz
	Test Port Cables
806-101	Flexible, V female to V male
3670V50-2 *2	Semi-rigid, V female to V male
	Semi-rigid, W1 male to W1 male

Model/Order No.	Name
	Calibration Kits
3654B	V-connector calibration kit with sliding terminations
3655W	WR-10 waveguide calibration kit
3655W-1	WR-10 waveguide calibration kit with sliding terminations
	Adapters (coaxial)
*2	W1 male to V male
*2	W1 male to V female
*2	W1 female to V male
*2	W1 female to V female
*2	W1 male to W1 male
*2	W1 male to W1 female
*2	W1 female to W1 female
	Adapters (waveguide to coaxial)
*2	WR-10 to W1 male
*2	WR-10 to W1 female
	On-Wafer Test Probes and Substrates (GGB Picoprobe®)
110H	110 GHz wafer probe, W1 female
67A	67 GHz wafer probe, V female
120 w/out Bias T	Extended W band wafer probe, WR10
120 w/ Bias T	Extended W band wafer probe, WR10, with bias tee
CS5	Calibration substrate

*1: 3742A-EW modules are equipped with an adjustable attenuator that is not available in the 3740A.
*2: Contact factory to place an order for the item.

VECTOR NETWORK ANALYZER AUTOMATIC CALIBRATOR
3658 Series
10 MHz to 40 GHz

Automatic, High-Reliability, and High-Quality Calibrators for Coaxial Device Measurements

The 3658 series AutoCal® modules are automatic calibrators that provide fast, repeatable, and high-quality coaxial calibrations up to 40 GHz. These modules contain precisely characterized calibration standards that aid in the removal of normal systematic errors when using vector network analyzers (VNAs). AutoCal® is available in five models: 0.04 to 18 GHz, with N (m) to N (f) connectors, 0.01 to 6 GHz and 0.04 to 20 GHz, with K (m) to K (f) connectors, and 0.04 to 40 GHz, with K (m) to K (f) connectors.
AutoCal® modules come with a data file characterizing each standard in the calibrator module. Each module is guaranteed to perform to its specifications for 6 months without re-characterization. Following this period, re-characterization can be performed by the customer, or by sending the module to the nearest service center.
Test port cable converter sets aid the user in calibrating a VNA for testing non-insertable devices and devices with SMA or 3.5 mm connectors. Test port converter sets are available for K Connector®, SMA, and 3.5 mm connectors. Adapter removal calibration is required for N type non-insertable device testing.
AutoCal® has a direct serial interface to the 37xxx and MS462x series of Anritsu vector network analyzers. The control software is built-in to the VNA. For operation with the 360B and/or older generation 37xxx models, an external PC running Microsoft Windows® with a National Instruments IEEE488.2 GPIB interface card is required.

Features

• Calibration types
1-port S_{11} and S_{22} calibration, and full 2-port, 12-term OSLT calibrations can be performed with AutoCal®.

• True thru
Inherently, the internal calibrator thru is not as accurate as an external direct thru connection. The true thru mode offers the choice of manually removing the AutoCal® module for a true thru calibration.

• Isolation cal
Isolation cal is offered as part of a full 2-port calibration. The user is given the option of skipping isolation, using the default averaging factor during isolation, or entering a custom averaging factor.

• Switch averaging
The mechanical module uses an electromechanical switch to select the calibration standards. Switch averaging is offered to reduce the effects of the electromechanical switch's non-repeatability. A 6 dB reduction of non-repeatability can be achieved by increasing switch averaging by a factor of four, at the expense of the overall calibration time.

• Thru update
Due to cable movements and aging, periodically updating the thru portion of a full, 12-term calibration is recommended. Thru update mode offers the choice of simply performing a direct manual thru step to update a current calibration. This is easily performed without having to invoke the AutoCal® module.

• Manual control
Manual control offers the ability to connect any of the internal standards to the test ports of the VNA. This feature could be used to manually verify a calibration.

• Adapter removal
VNA calibration for testing non-insertable devices, requires phase equal insertables. If this is not possible or is undesirable, adapter removal calibration is the solution. Adapter removal requires two full 12-term calibrations, moving an adapter from one test port cable to the other between calibrations (a job AutoCal® makes quick and easy). Internal software mathematically subtracts the effect of the adapter, yielding the desired adapterless measurement.

For product ordering information, see pages 4 – 10

Specifications

All specifications are guaranteed over the ambient temperature range of 23˚ ±3˚C.

• Directivity

Frequency	AutoCal® module	AutoCal® with 36583X
0.01 to 0.2 GHz	38 dB	36 dB
0.2 to 20 GHz	38 dB	36 dB
20 to 40 GHz	34 dB	32 dB

• Source match

Frequency	AutoCal® module	AutoCal® with 36583X
0.01 to 0.2 GHz	34 dB	32 dB
0.2 to 20 GHz	34 dB	32 dB
20 to 40 GHz	26 dB	24 dB

• Reflection tracking

Frequency	AutoCal® module	AutoCal® with 36583X
0.01 to 0.2 GHz	±0.15 dB	±0.20 dB
0.2 to 20 GHz	±0.20 dB	±0.25 dB
20 to 40 GHz	±0.25 dB	±0.30 dB

• Transmission tracking (Internal thru mode)

Frequency	AutoCal® module	AutoCal® with 36583X
0.01 to 0.2 GHz	±0.15 dB	±0.20 dB
0.2 to 20 GHz	±0.20 dB	±0.25 dB
20 to 40 GHz	±0.25 dB	±0.30 dB

• Transmission tracking (True thru mode)

Frequency	AutoCal® module	AutoCal® with 36583X
0.01 to 0.2 GHz	±0.10 dB	±0.15 dB
0.2 to 20 GHz	±0.10 dB	±0.15 dB
20 to 40 GHz	±0.20 dB	±0.25 dB

General

• Serial input connector
9 pin D-sub allowing PC or direct VNA control. (Serial cable supplied)

• Power supply input connector
+5 V, ±15 V for the electronic modules, and +5 V, +24 V for the electromechanical module. The modules are keyed against plugging the wrong supply. The appropriate DC supply is supplied with each AutoCal® module. These universal supplies will operate at either 110 V or 220 V input voltages.

• Power LED
On when the DC supply is plugged in.

• Operate LED
On when the module's internal temperature has stabilized at an optimum temperature for accurate calibrations.

• Dimensions
155 (W) x 65 (H) x 90 (D) mm (6 W x 2.5 H x 3.5 D in.)

Environment

• Operating temperature
18˚ to 28˚C

• Storage temperature
–20˚ to 70˚C

• Relative humidity
5% to 95% at 40˚C

• EMC
Conforms to the EMC Directive, 89/336/EEC
Conducted and Radiated Emissions-
CISPR 11: 1990/EN55011: 1991,
Group 1 Class A
Immunity-
IEC 1000-4-2:1995/EN 50082-1: 1992,
4 kV CD, 8 kV AD
IEC 1000-4-3:1995/EN 50082-1: 1992,
3 V/m, 26-1000 MHz, 80% 1 kHz AM
IEC 1000-4-4: 1995/EN 50082-1: 1992,
.5 kV SL, 1 kV PL

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
36581NNF	AutoCal® (N type, 40 MHz to 18 GHz)
36581KKF	AutoCal® (K type, 40 MHz to 20 GHz)
36582KKF	AutoCal® (K type, 40 MHz to 40 GHz)
36581NNF/1	AutoCal® (N type, 10 MHz to 6 GHz)
36581KKF/1	AutoCal® (K type, 10 MHz to 6 GHz)
	Test port converter sets
36583S	SMA type
36583L	3.5 mm type
36583K	K type
	Service
2300-228	Re-characterization software

AutoCal® may be sent to the nearest service center for re-characterization, or a service engineer may perform the task at the customer's site. With the aid of the re-characterization software, a Lightning or Scorpion family VNA, and a traditional cal kit, the customer can re-characterize his own AutoCal® module, minimizing downtime.

VNA AND VNMS
Calibration Kits

For Performing Precise Calibrations of Vector Network Analyzers

3753LF

3651, Option 1

The Anritsu Calibration Kits contain all the precision components and tools required to calibrate your VNA or VNMS for 12-term error-corrected measurements in the connector style of your choice. Components are included for calibrating male and female test ports as required. The kits support calibration with opens, shorts, and broadband loads. Option 1 adds sliding terminations and a pin depth gauge where required.

The following kits are for use with 37XXX Lightning VNAs.

3650 SMA/3.5 mm Calibration Kit consisting of:
- 34ASF50-2 Female Adapter (2)
- 33FSF50 Female-Female Adapter (2)*
- 33SS50 Male-Male Adapter*
- 28S50-2 B Male Termination (2)
- 28SF50-2 Broadband Female Termination (2)
- 33SSF50-Male-Female Adapter (2)*
- 24S50 Male Open
- 23SF50 Female Open
- 23S50 Male Short
- 23SF50 Female Short
- 34AS50-2 Male Adapter (2)
- Connector Thumb Wheel (4)
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-222 Pin Depth Gauge
- 01-223 Pin Depth Gauge
- Calibration coefficients diskette

Option 1

Adds the following:
- 01-212 Female Flush Short
- 01-211 Male Flush Short
- 17SF50 Female Sliding Termination
- 17S50 Male Sliding Termination

3651 GPC-7 Calibration Kit consisting of:
- 28A50-2 Broadband Termination (2)
- 24A50 Open
- 23A50 Short
- 01-200 Torque Wrench
- 01-221 Collet Extractor Tool and 4 Collets
- Calibration coefficients diskette

* Phase Equal Adapters

Option 1

Adds the following:
- 17A50 Sliding Termination
- 01-210 Reference Flat
- 01-220 Pin Depth Gauge

3652 K Connector® Calibration Kit consisting of:
- 34AKF50-2 Female Adapter (2)
- 33FKF50 Female-Female Adapter (2)*
- 33KK50 Male-Male Adapter*
- 28K50-2 Male Termination (2)
- 28KF50-2 broadband Female termination (2)
- 33KKF50-Male-Female Adapter (2)*
- 24K50 Male Open
- 23KF50 Female Open
- 23K50 Male Short
- 23KF50 Female Short
- 34AK50-2 Male Adapter (2)
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-222 Pin Depth Gauge
- 01-223 Pin Depth Gauge
- Calibration coefficients diskette
- Connector thumb wheel (4)

Option 1

Adds the following:
- 17KF50 Female Sliding Termination
- 17K50 Male Sliding Termination
- 01-212 Female Flush Short
- 01-211 Male Flush Short

3653 Type N Calibration Kit consisting of:
- 23NF50 Female Short
- 23N50 Male Short
- 24NF50 Female Open
- 24N50 Male Open
- 28N50-2 Broadband Male Termination (2)
- 28NF50-2B Brodband Female Termination (2)
- 34AN50-2 Male Adapter (2)
- 34ANF50-2 Female Adapter (2)
- 01-213 Reference Gauge
- 01-224 Pin Depth Gauge
- Calibration coefficients diskette

For product ordering information, see pages 4 – 10

3654B V Connector® Calibration Kit consisting of:
- 23V50B-5.1 Male Short 5.1mm
- 23VF50B-5.1 Female Short 5.1mm
- 24V50B Male Open
- 24VF50B Female Open
- 28V50B Male Broadband Termination (2)
- 28VF50B Female Broadband Termination (2)
- 17VF50B Female Sliding Termination
- 17V50B Male Sliding Termination
- 33VV50 Male-Male Adapter*
- 33VFVF50 Female-Female Adapter (2)*
- 33VVF50 Male-Female Adapter (2)*
- Calibration coefficients diskette
- Connector thumb wheel (4)
- 01-201 Torque Wrench
- 01-210 Reference Flat
- 01-322 Pin Depth Gauge
- 01-323 Female Adapter for pin gauge
- 01-204 Adapter Wrench
- 01-312 Male Flush Short
- 01-311 Female Flush Short

3655 Waveguide Calibration Kit
The 3655 Calibration Kit contains all of the precision components and tools required to calibrate your VNA for 12-term error-corrected measurements of test devices with the appropriate waveguide designation. Components are included for calibrating both module ports. The kit supports calibration with offset shorts and broadband loads. Option 1 adds a sliding termination.

Consisting of:
- Short, Flush (2)
- Offsets, 1/8 and 3/8 Wavelength
- Terminations, Fixed (2)
- Test Port Sections (2)

Option 1
Adds the following:
- Sliding Termination

3750 SMA/3.5 mm Calibration Kit consisting of:
- 23LF50 Female Short
- 23L50 Male Short
- 24LF50 Female Open
- 24L50 Male Open
- 28L50 Male Termination (2)
- 28LF50 Female Termination (2)
- Calibration coefficients diskette

3751 GPC-7 Calibration Kit consisting of:
- 23A50 Short
- 24A50 Open
- 28A50 Termination (2)
- Calibration coefficients diskette

Option 1
Adds the following:
- 28A50LF 3rd Termination

3753 Type N Calibration Kit consisting of:
- 23NF50 Female Short
- 24NF50 Female Open
- 24N50 Male Open
- 28NF50 Female Termination (2)
- 28N50 Male Termination (2)
- 23N50 Male Short
- Calibration coefficients diskette

The following kits are for use with MS462XX Scorpion VNAs.
3750LF SMA/3.5 mm 6 GHz Calibration Kit consisting of:
- 23LF50 Female Short
- 23L50 Male Short
- 24LF50 Female Open
- 24L50 Male Open
- 28L50LF Male Termination (2)
- 28LF50LF Female Termination (2)
- Calibration coefficients diskette

3751LF GPC-7 6 GHz Calibration Kit consisting of:
- 23A50 Short
- 24A50 Open
- 28A50LF Termination (2)
- Calibration coefficients diskette

Option 1
Adds the following:
- 28A50LF 3rd Termination

3753LF Type N 6 GHz Calibration Kit consisting of:
- 23NF50 Female Short
- 24NF50 Female Open
- 24N50 Male Open
- 28NF50LF Female Termination (2)
- 28N50LF Male Termination (2)
- 23N50 Male Short
- Calibration coefficients diskette

Ordering information
Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name
	Calibration kits
3650	SMA/3.5 mm calibration kit
Option 1	Adds sliding terminations
3651	GPC-7 calibration kit
Option 1	Adds sliding terminations
3652	K Connector® calibration kit
Option 1	Adds sliding terminations
3653	Type N calibration kit
3654B	V Connector® calibration kit with sliding terminations
3655	Waveguide calibration kit
Option 1	Adds sliding terminations
3750	SMA/3.5 mm 8.6 GHz calibration kit
3750LF	SMA/3.5 mm 6 GHz calibration kit
3751	GPC-7 8.6 GHz calibration kit
3751LF	GPC-7 6 GHz calibration kit
3753	Type N 8.6 GHz calibration kit
3753LF	Type N 6 GHz calibration kit
3753-75	75 Ohm Type N 3 GHz calibration kit

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* Phase Equal Adapters

VNA AND VNMS
Verification Kits

For Confirming Accuracy of Vector Network Analyzers

3669B

The Anritsu Verification Kits contain precision components with characteristics that are traceable to NIST. Used primarily by the metrology laboratory, these components provide the most dependable means of determining the system accuracy of your VNA. A disk containing factory measured test data for all components is supplied for comparison with customer-measured data.

The following kits are for use with 37XXX Lightning VNAs.

3663 Type N Verification Kit consisting of:
- 42N-50, 50 dB Attenuator
- 18N50-10, 10 cm Airline
- 42N20, 20 dB Attenuator
- 18N50-10B, 10 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3665 Waveguide Verification Kit consisting of:
- Straight section
- Pin set
- Mismatch section
- Ball driver
- 50 dB Attenuator
- 20 dB Attenuator
- Verification kit disks

3666 SMA/3.5 mm Verification Kit consisting of:
- 19S50-7, 7.5 cm Airline
- 19SF50-7B, 7.5 cm Stepped Impedance Airline (Beatty standard)
- 42S-50, 50 dB Attenuator
- 42S-20, 20 dB Attenuator
- Verification kit disks

3667 GPC-7 Verification Kit consisting of:
- 42A-50, 50 dB Attenuator
- 18A50-10, 10 cm Air line
- 42A-20, 20 dB Attenuator
- 18A50-10B, 10 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3668 K Connector® Verification Kit consisting of:
- 19K50-7, 7.5 cm Airline
- 42K-50, 50 dB Attenuator
- 42K-20, 20 dB Attenuator
- 18K50-7B, 7.5 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

3669B V Connector® Verification Kit consisting of:
- 42V-40, 40 dB Attenuator
- 42V-20, 20 dB Attenuator
- 19V50-5, 5 cm Airline
- 18V50-5B, 5 cm Stepped Impedance Airline (Beatty standard)
- Verification kit disks

The following kits are for use with MS462XX Scorpion VNAs.

3663LF Type N 6 GHz Verification Kit consisting of:
- 42N-50, 50 dB Attenuator
- 42N20, 20 dB Attenuator
- 42NOP-20 N Mismatch attenuator
- Verification kit disks

3666LF SMA/3.5 mm 6 GHz Verification Kit consisting of:
- 42L-50, 50 dB Attenuator
- 42L-20, 20 dB Attenuator
- 42LOP-20 SMA/3.5 mm Mismatch Attenuator
- Verification kit disks

3667LF GPC-7 6 GHz Verification Kit consisting of:
- 42A-50, 50 dB Attenuator
- 42A-20, 20 dB Attenuator
- 42AOP-20 GPC-7 Mismatch Attenuator
- Verification kit disks

Ordering information

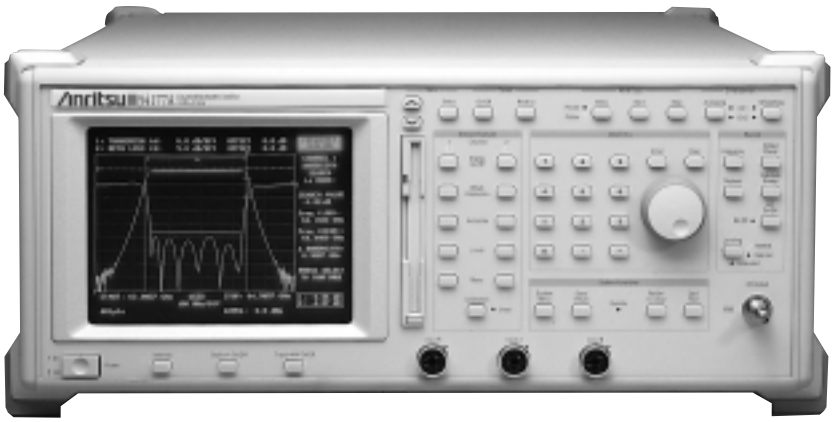
Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name
	Verification kits
3663	Type N verification kit
3665	Waveguide verification kit
3666	SMA/3.5 mm verification kit
3667	GPC-7 verification kit
3668	K connector® verification kit
3669B	V connector® verification kit
3663LF	Type N 6 GHz verification kit
3666LF	SMA/3.5 mm 6 GHz verification kit
3667LF	GPC-7 6 GHz verification kit

For product ordering information, see pages 4 – 10

NETWORK ANALYZER
54100A Series
1 MHz to 110 GHz

Fast and Accurate Scalar Network Measurements, with Built-in Source



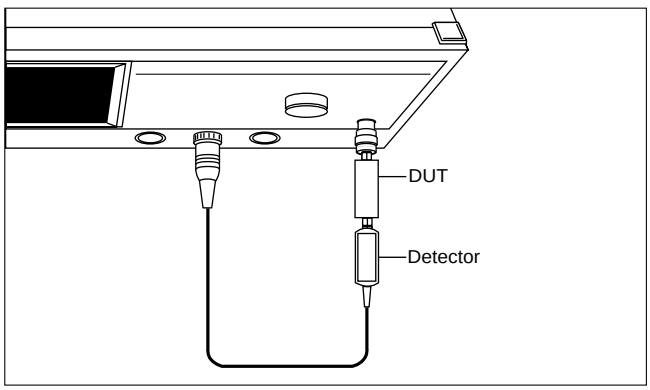
GPIB

54100A series Network Analyzers provide characterization of devices such as amplifiers, antennas, attenuators, adapters, RF bridges, duplexers, couplers, attenuators, cables, waveguide transmission lines, isolators, circulators, mixers, receivers, transceivers, up/down converters, multiplexers, power dividers, VCOs, switches, and filters. Advanced hardware and software features speed productivity and improve accuracy. Speed tuning processes with automated bandwidth search functions. Fast recall mode quickly steps through test procedures and sophisticated limit line controls quickly identify conformance to specifications. Low source harmonics and high directivity SWR autotesters assure accuracy.

Features

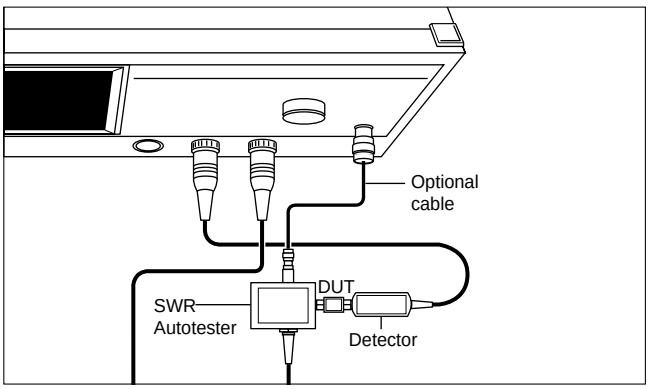
- Fast, accurate measurement of transmission, return loss, precision return loss, SWR, group delay, absolute power, and distance-to-fault
- Crystal-based source for exceptional stability and accuracy
- Built-in automation features including distance-to-fault
- Built-in floppy disk drive
- Rugged, reliable chassis
- **Transmission gain (loss), group delay and power measurements**

The basic configuration requires a single detector. For very low transmission loss devices (<0.25 dB), a second detector should be used to monitor any source power variations.

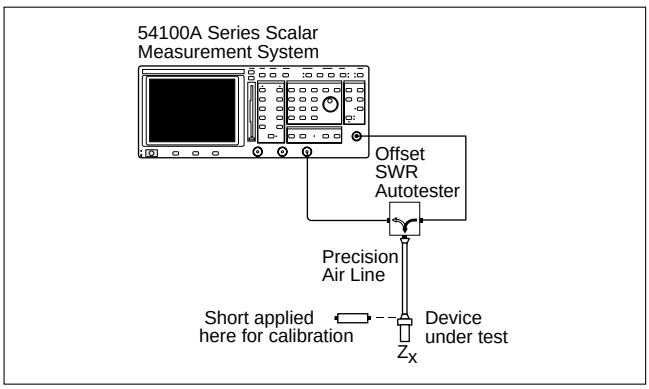


- **Transmission and return loss (or SWR)**

Return loss or standing wave ratio (SWR) measurements require a high directivity SWR autotester to separate the incident signal from the RF sweep source and reflected signal from the device under test. The configuration below will simultaneously display transmission and return loss characteristics.

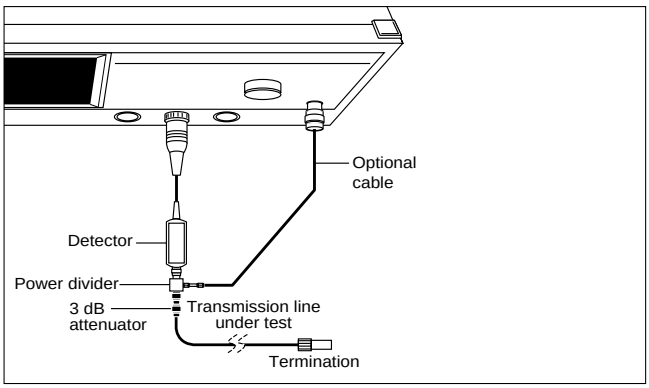


• Adapters, attenuators, terminations, couplers, RF bridges
The 54100A series precision return loss mode measures high return loss devices accurately traceable to NIST. The measurement system uses an offset SWR autotester and a precision airline — a physical impedance standard. Additionally, by exchanging the offset SWR autotester with a 20 dB offset termination, the directivity of couplers and RF bridges is displayed directly on the 54100A.



Distance-to-fault

The 54100A's optional distance-to-fault software accurately verifies transmission line and antenna system performance during installation, link/site commissioning, and at regular maintenance intervals. Transmission lines are typically the most common failure point in an antenna system. Finding the problem connectors, cables, and antennas before a complete failure occurs saves down-time and expense. Faulty antenna systems and transmission lines are easily diagnosed. A wide variety of coaxial and waveguide types are supported with standard catalog components.



Common causes of antenna feed problems

• Cable and waveguide problems
Cable discontinuities
Moisture
Braid wire ground shield fault (appears as a notch filter)
Damaged/cut ground shields
Dielectric fault or narrowed dielectric diameter
Fasteners pinch cables

• Connector problems
Corroded connectors
Low quality connectors
Connector pin offset (poor mating contact)

• Antenna problems
Antenna out of specification
Antenna storm/shipping damage

Performance

• Preventing "ghost" faults
The 54100A uses a low harmonic source and high performance anti-aliasing software to prevent the display of false or "ghost" transmission line faults. This is a common problem when the end of the DUT is unterminated or damaged. Anritsu's precision components and low harmonic sources prevent "ghost" faults, assuring accurate, repeatable results.

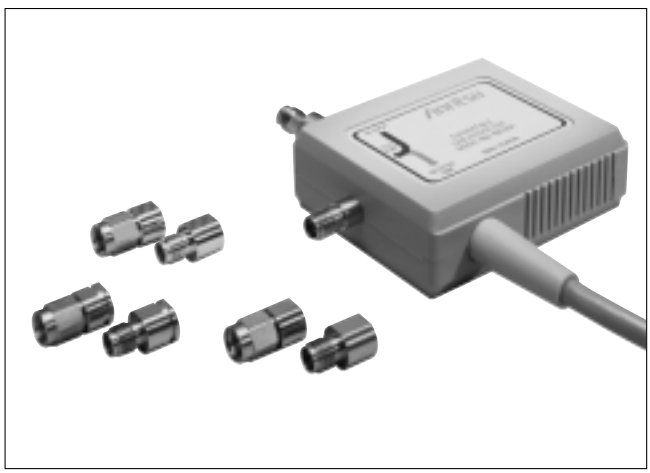
• High dynamic range
The 54100A distance-to-fault software optimizes sensitivity and accuracy. For example, a precision termination is used during calibration to achieve industry leading dynamic range. If the termination is not of high quality, it will reflect some of the source energy rather than absorb it –causing errors in the measurement process. The use of a specialized discrete fourier transform rather than a more common fast fourier transform also improves low level sensitivity. Low source harmonics also ensure that fault indications are actual transmission line and not re-reflections of source harmonic energy.

Relative group delay

Optional relative group delay software identifies signal distortion caused by bandpass devices such as filters, receivers, power amplifiers, and up/down converters. Group delay is a key cause of high bit error rate (BER). Group delay is important for (1) CDMA and spread spectrum communications, (2) phase array radars, (3) high capacity satellite and terrestrial microwave links, and (4) PAL and HDTV television components and other RF systems sensitive to phase distortion. The 54100A saves time and expense by eliminating several pieces of expensive test equipment – combining the capabilities into a single, low cost test station. Manufacturing processes save re-test/re-tuning time by utilizing a single 54100A instead of two separate tuning stations – one for scalar transmission and return loss and the other for relative phase group delay. Furthermore, the 54100A can accurately test frequency conversion devices without the wideband reference converters required with vector network analyzers or microwave system analyzers.

Convertible SWR autotester

Convertible SWR autotesters reduce capital equipment and maintenance costs. A single convertible SWR autotester accurately measures the return loss or SWR of devices with SMA, 3.5 mm, or K connectors. Six interchangeable test port heads (male and female for each connector standard) are precision tuned to the convertible SWR autotester's internal bridge circuit.



The 560-98C50 Convertible SWR Autotester improves test accuracy and reduces maintenance cost without using error prone test port adapters or connector savers.

The inexpensive test port heads save repair and calibration costs because they are interchangeable.

For product ordering information, see pages 4 –10

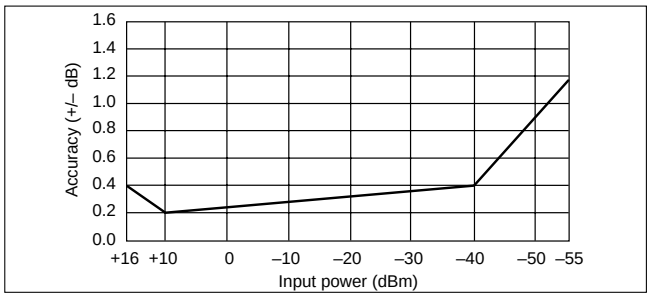
Measurement accuracy

• Transmission loss or gain measurement accuracy

Uncertainties from the frequency response of components are automatically subtracted from test data during the path calibration procedure. Overall accuracy is then:

Channel accuracy
+ Mismatch uncertainty
+ Distortion from source harmonics
Transmission measurement accuracy

Effects of source, test device, SWR autotester, and detector mismatch can be significant. This mismatch uncertainty is minimized by the exceptionally low reflection characteristics of Wiltron's detectors, sources, and SWR autotesters. Anritsu's ultra low source harmonics maximize the accuracy.



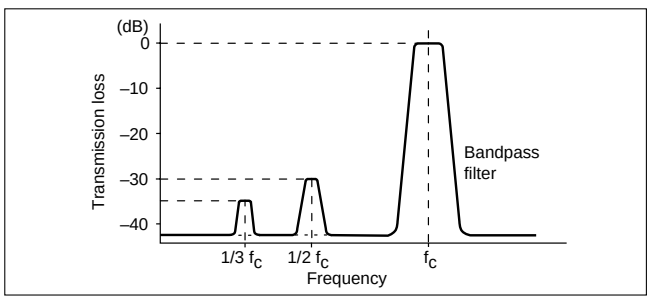
Channel accuracy (25˚C)

• Distortion from source harmonics

Poor source harmonics cause large measurement errors. If the sweep range is set wide enough, at some point during the sweep, the harmonic will pass through the filter's pass band. Since the transmission detector is a broadband diode, the harmonic's signal power is measured. Thus, the analyzer displays the response of the harmonic in addition to the fundamental sweep frequency.

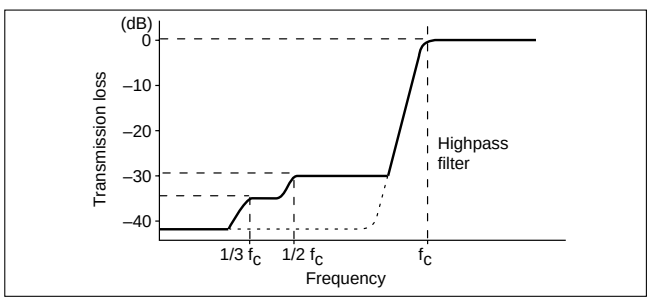
• Bandpass filter, distortion from source harmonics

If the source has a –30 dBc second harmonic and a –35 dBc third harmonic, at the beginning of the sweep, the harmonics pass through the filter's passband.



• Highpass filter, distortion from source harmonics

A highpass (or wide bandpass) filter responds similarly to the bandpass filter, except the presence of the harmonic in the filter's pass band limits the useful dynamic range of the analyzer.



Return loss measurement accuracy

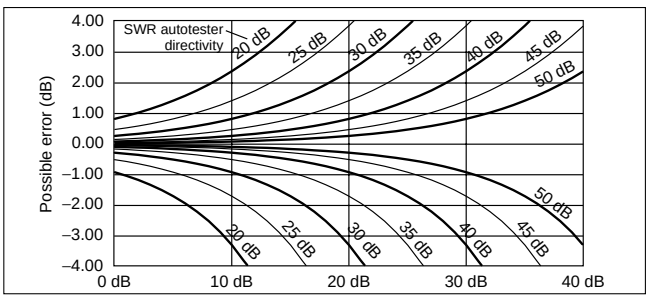
Uncertainties resulting from SWR autotester and source frequency response and from system open and short characteristics are subtracted automatically from test data. Overall accuracy is then:

Channel accuracy
+ Autotester accuracy
+ Distortion from source harmonics
Return loss measurement accuracy

Autotester accuracy is composed of error due to directivity and error due to test port match. Unless the DUT has very poor return loss (high SWR), test port match will be negligible. When an adapter is used at the test port, use effective directivity to determine possible errors.

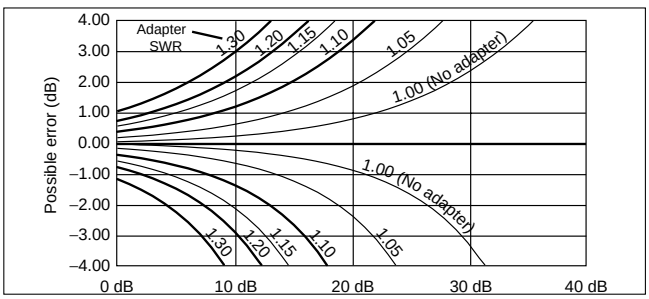
• Return loss accuracy due to directivity

Improved directivity decreases SWR (or return loss) measurement errors. The chart below identifies maximum error due to directivity.



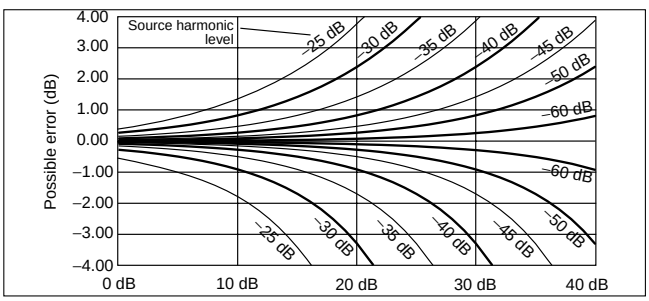
• Return loss accuracy due to effective directivity

Effective directivity is the reduction to directivity due to a test port adapter's SWR performance. Adapters severely degrade measurement directivity. The chart below shows the maximum degradation to a 40 dB directivity SWR autotester caused by test port adapters of varying quality.



• Return loss accuracy due to source harmonics

Source harmonics are a significant source of return loss measurement uncertainty when testing banded devices such as filters, receivers, transmitters, power amplifiers, and antennas. In many cases, the harmonic errors are larger than uncertainty due to directivity, which is typically assumed to be the largest uncertainty factor.



This chart assumes full reflections of a single source harmonic at the DUT input. Multiple harmonics can cause additional measurement uncertainty.

7

Specifications

Analyzer	Measurement modes	Transmission (dB), return loss (dB), SWR (linear SWR), optional group delay (ns), power (dBm) precision return loss (dB) and optional distance-to-fault
	Dynamic range	–55 to +16 dBm, autozeroing with DC detection
	Inputs	Three, two standard inputs, A and B, with optional third reference channel, R (Option 5)
	Display channels	Two channels are used to select and simultaneously display any two inputs from A, B, or R. The inputs can also be displayed as ratios A/R or B/R.
	Scale resolution	0.1 to 10 dB(m) per division in 0.1 dB steps
	Cursor functions	Searches for trace maximum, minimum, dB level, dB bandwidth, next marker and active marker
	Averaging	2, 4, 8, 16, 32, 64, 128, or 256
	Limit lines	Two limit lines, either single value or multi level segmented, for each trace. Segmented lines may be made from up to 10 individually editable segments.
	Auto-zero	Performs an AC modulation cycle and low level calibration during sweeper retrace
	Save/Recall	Thirteen sets of front panel set-ups and thirteen sets of trace memory can be stored in non-volatile instrument memory.
	Trace mask	A swept frequency measurement can be stored to a graticule trace mask for visual comparison to later measurements.
	Disk drive	Built-in 3.5 inch, 1.44 MB floppy disk drive
	Autosave	Automatically increments the trace data file name and reference number during successive data storage operations to the DOS disk
Source	Frequency range	1 MHz to 110 GHz, model dependent
	Alternate sweep	Sweeps alternately between frequency ranges set differently for channel 1 and channel 2
	CW	Provides single frequency output (both channels turned off)
	Frequency resolution	RF Models (54107A, 54109A, 54111A): 10 kHz, Microwave models: 100 kHz
	Output power	Maximum guaranteed levelled output power is model dependent.
	Reverse power protection	Up to 5 Watts. Limited to 1 Watt with attenuator option
Application function	Min/Max hold	Save the minimum and maximum values of successive sweeps or the combination of the two
	Cursor functions	Automatic cursor search updates the bandwidth, minimum, or maximum levels of the displayed trace.
	Compression test automation	Determines the gain compression point over the operating frequency range of an amplifier by successively incrementing the source power and measuring the amount of compression until a preset “X” dB limit is exceeded.
	Self test	Performs a self test every time power is applied or when SELF TEST pushbutton is pressed. If an error is detected, a diagnostic code appears, identifying the cause and location of the error.
General	Operating temperature	0˚ to +50˚C
	Power	115 V $^{+10}_{-20}$ %, 230 V $^{+10}_{-20}$ %, 48 to 400 Hz, 300 VA
	Mass	18 kg (39 lb.)
	Printer	Parallel printer interface is compatible with the Canon BJ85 and most Epson FX-compatible printers.
	Transit case	Hard shell case with custom foam inserts, PN: 760-183
	EMC	Meets European community requirements for CE marking

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
54107A	Scalar Measurement System (0.001 to 1.5 GHz)
54109A	Scalar Measurement System (0.001 to 2.2 GHz)
54111A	Scalar Measurement System (0.001 to 3.0 GHz)
54137A	Scalar Measurement System (2 to 20 GHz)
54147A	Scalar Measurement System (0.01 to 20 GHz)
54163A	Scalar Measurement System (2 to 40 GHz)
54169A	Scalar Measurement System (0.01 to 40 GHz)
54177A	Scalar Measurement System (0.01 to 50 GHz)

Model/Order No.	Name
	Options
Option 1	Rack mounting with slides
Option 2	70 dB RF step attenuator
Option 2A	70 dB, 20 GHz MW step attenuator
Option 2C	70 dB, 40 GHz MW step attenuator
Option 2D	70 dB, 50 GHz MW step attenuator
Option 4	75 Ω source output (available to 3.0 GHz)
Option 5	Add reference channel
Option 6	Add external levelling
Option 7	Internal distance-to-fault software
Option 8	Internal relative group delay software
Option 12	Add front panel cover
Option 13	Add front mounted handles
Option 16	+15 V DC supply for millimeter wave source modules (available with <20 GHz models only)
Option 25	Maintenance manual
Option 26	Extra operation and GPIB programming manual
Option 33	Canon printer

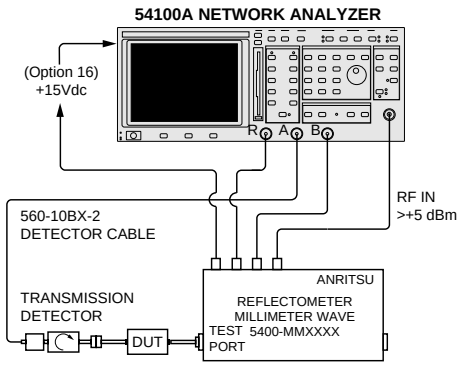
For product ordering information, see pages 4 –10

MILLIMETER WAVE MEASUREMENT SYSTEM
54000 Series
50 GHz to 110 GHz

Scalar Measurements to 110 GHz from an Integrated System

CE GPIB

The Anritsu's Millimeter Wave Reflectometers are designed to operate with the 54147A 20 GHz Network Analyzer. The milli-meter wave multiplier includes subharmonic filters and an isolator, to dramatically improve reflection accuracy.



Millimeter wave reflectometer configuration

Excellent multiplier source match provided by the internal isolators and the improved detector return loss allow accurate, simultaneous return loss and transmission measurements.

Features
- Operates with standard 54147A analyzer
- 40 dB (typical) directivity for accurate SWR measurements
- Millimetric waveguide detectors for loss/gain measurements

7

Specifications

Reflection accuracy characteristics	Source match	<1.9 (<1.7 Typical)
	Directivity	35 dB (>40 dB Typical)
	Dynamic range	>56 dB
	Channel accuracy	Channel accuracy is degraded by ±0.4 dB from standard 54100A specifications
	Output power, minimum	Leveled or unleveled V-band: 0.0 dBm min. (+4.0 dBm Typ.) W-band: –5.0 dBm min. (+1.0 dBm Typ.)
	Power flatness, unleveled	±3.0 dB Typ.
	Required input frequency	V-band: 12.75 to 18.75 GHz, W-band: 12.75 to 18.33 GHz
	Required input harmonics	<–60 dBc
	Spurious signals	Harmonic: <–55 dBc (<–60 dBc Typical), Nonharmonic: <–55 dBc (<–60 dBc Typical)
	Frequency accuracy	Source dependent
	Frequency resolution	Source dependent
Millimeter reflectometer accessories	12" N (m) to N (m) RF input cable	PN: N120-12
	Precision attenuators	1.08: 1.0 SWR Precision loads and attenuators allow low insertion loss devices such as couplers and wavequide sections to be accurately tested. V band 3 dB: SM4784; 6 dB, SM4786 W band 3 dB: SM4785; 6 dB, SM4787
	Precision loads	1.06: 1.0 SWR V band, SM4782 W band, SM4783
	DC power connections	SM4819 Twinax (m) - Twinax (m) cable SM4816 Twinax to dual banana plug SM4818 Twinax to dual EZ hooks
Physical	Size	9.5 x 4.5 x 1.5 inches
mmWave	Maximum input power, damage level	+21 dBm

Special Waveguide Reflectometers (Reflectometers have integrated multipliers/amplifiers. Input frequency is < 20 GHz)					
Model	Frequency range	Directivity	Test port		Input connector
			SWR	Flange	
54000-6WR15	50 to 75 GHz	35 dB, 40 dB typ.	<1.9 (<1.7 typ.)	WR-15	N (f)
54000-6WR10	75 to 110 GHz	35 dB, 40 dB typ	<1.9 (<1.7 typ.)	WR-10	N (f)
Millimeter Wave Detectors					
Model	Frequency range	Dynamic range	Input port		Output connector
			Return loss	Flange	
54000-7WR15	50 to 75 GHz	> 56 dB typ.	17 dB	WR-15	BNC (f)
54000-7WR10	75 to 110 GHz	> 56 dB typ	17 dB	WR-10	BNC (f)

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
54000-6WR15	Millimeter Wave Module
54000-6WR10	Millimeter Wave Module
54000-7WR15	Millimeter Wave Module
54000-7WR10	Millimeter Wave Module

For product ordering information, see pages 4 – 10

NETWORK ANALYZER
MS4630B
10 Hz to 300 MHz

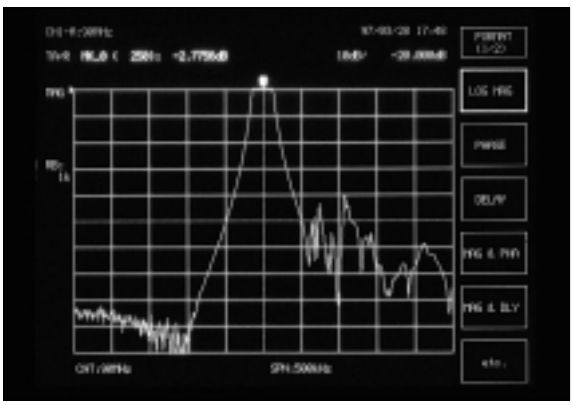
For Fast Evaluation of IF Filters and Resonators

CE GPIB

The MS4630B is suitable for electronics production lines demanding fast and accurate device measurements. It is particularly well suited to accurate, high-speed evaluation of IF filter resonance and group delay characteristics, as well as evaluating the impedance characteristics of resonators in AV equipment and personal computers. A fast sweep speed of 150 µs/measurement point is achieved using a high-speed synthesizer and digital signal processing (DSP) technologies. The post-processing data analysis functions have been strengthened with improved data-processing macros that have greatly increased the total production throughput.
In comparison to the earlier MS3401A/B and MS3606B network analyzers, the sweep speed is three times faster and the group delay measurement accuracy and stability have been improved by more than 10 times. In addition, the dynamic range has been improved to 120 dB (RBW: 1 kHz) while the weight of the analyzer has been dramatically reduced. The GPIB and PTA processing speed are 30 to 50% faster than the MS4630A. In addition, the sweep conditions can be set more easily by the addition of the list sweep function.

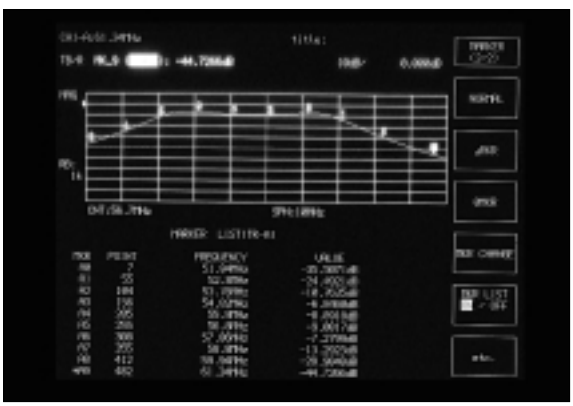
Features
- High-speed evaluation of IF filters, resonators, etc.
- Greatly increased production/inspection capacity

Performance and functions
• High dynamic range
The high dynamic range of 120 dB (RBW: 1 kHz) permits fast and accurate out-of-band measurement of filter.



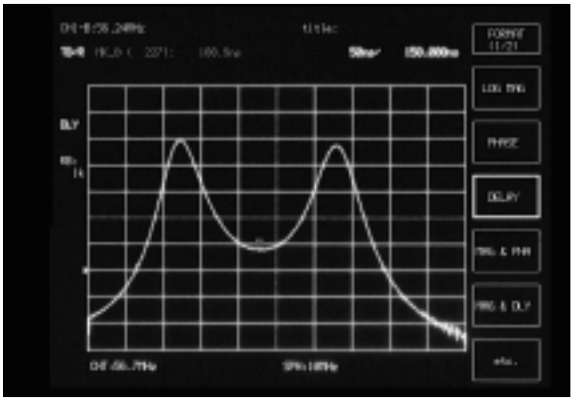
Filter out-of-band attenuation measurement

• Multi-marker function
Up to 10 markers can be set independently for each channel. The marker list function can be used to display all tabular data and waveform information simultaneously at each marker.



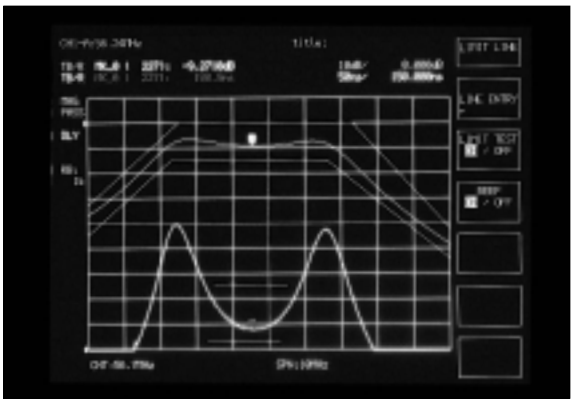
Multi-markers

• High-accuracy group delay measurement
The group delay characteristics can be measured with a high degree of accuracy at a resolution of 1/10,000 of the measurement range.



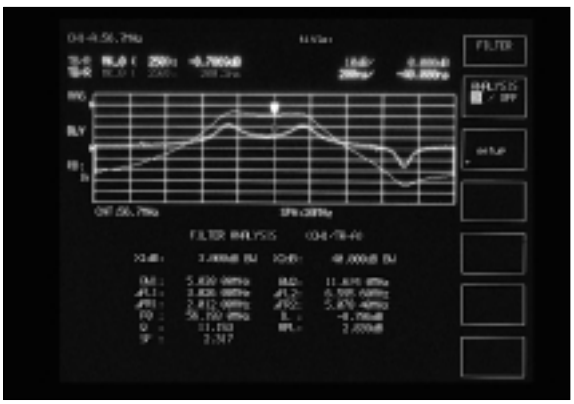
Group delay characteristics

• Limit test function
Device pass/fail evaluation can be performed in real-time using the single and segmented limit test functions.



Filter pass/fail evaluation using limit test

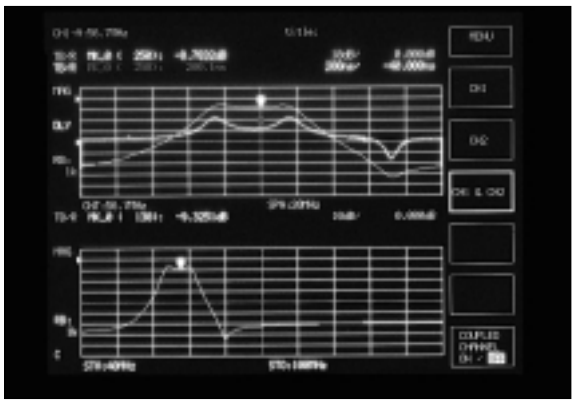
• Filter measurement
Filter analysis functions
Filter characteristics such as 3 dB bandwidth, center frequency (fo), in-band ripple, out-of-band attenuation, etc., are digitally processed and analyzed at high speed. User can easily enter or change default values using filter set up menu.



Measurement using filter functions

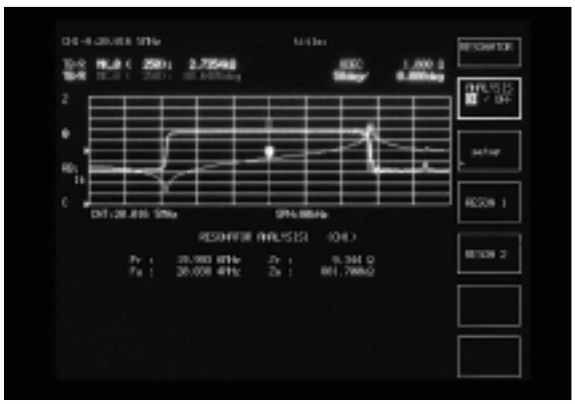
Set up menu for filter functions

Simultaneous in-band and spurious response data display
Previously, spurious detection and passband measurement required switching of the measurement setup. The MS4630B alternate sweeping function permits simultaneous display of the measured passband and spurious band data. The very short switching time greatly improves the measurement efficiency.



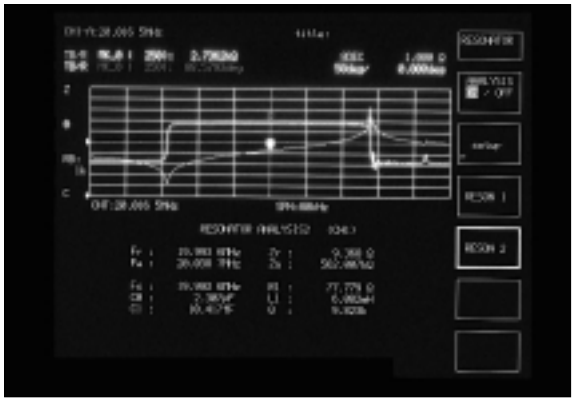
Spurious measurement using alternate sweeping

• Resonator measurement
High-speed measurement of resonator characteristics
The MS4630B has a number of dedicated waveform analysis functions to improve the evaluation efficiency of resonators. Resonator 1 analyzes the resonance frequency (Fr) and the resonance impedance (Zr). Resonator 2 is able to measure resonator equivalence in addition to the parameters for Resonator 1.



Resonator 1 measurement

For product ordering information, see pages 4 – 10



Resonator 2 measurement

Specifications

Measurement items	Transmission characteristics (ratio measurement): Amplitude, phase, group delay Reflection/impedance characteristics: Amplitude, phase (with external transducer) Level characteristics: Absolute amplitude
Frequency	Range: 10 Hz to 300 MHz Resolution: 0.01 Hz Accuracy (standard) Aging rate: ≤1 x 10^{-6}/day (15 minutes after power-on) Temperature characteristics: ≤±5 x 10^{-6} (0˚ to 50˚C) Accuracy (Option 13: High-stability reference oscillator) Aging rate: ≤±2 x 10^{-8}/day (24 h after power-on) Temperature characteristics: ≤±5 x 10^{-8} (0˚ to 50˚C)
Input	Channel No. Standard: 2 (R, TA); Option 12: 3 (R, TA, TB) Impedance: 50 Ω, 1 MΩ switchable (when combined with MA4605A: 75 Ω, 1 MΩ) Input range (IRG): 0/+20 dBm Max. input power AC: +20 dBm; DC ±2.2 V (50 Ω) AC: 0 dBm; DC: ±20 V (1 MΩ) Connector: BNC-J Probe source: +12 ±1 V, 100 mA (with protective circuit for shorts)
Average noise level	≤–120 dBm (RBW: 1 kHz, 1 to 300 MHz), ≤–110 dBm (RBW: 1 kHz, 80 kHz to 1 MHz)
Crosstalk	Between channels: ≥120 dB (80 kHz to 300 MHz), ≥110 dB (up to 80 kHz) Between transmitter and receiver: ≥125 dB
Resolution bandwidth	3, 10, 30, 100, 500 Hz, 1, 2, 3, 4, 5, 10, 20 kHz and automatic setting
Output	Output level range Output A: 0 to +21 dBm; Option 10: –70 to +21 dBm Output B: –6 to +15 dBm (–9.5 to +11.5 dB when Option 14 added); Option 10: –76 to +15 dBm (–79.5 to +11.5 dB when Option 14 added) Output resolution: 0.01 dB Output level accuracy: ≤±1.0 dB (frequency: 100 MHz, Output A: +10 dBm) Output level linearity: ≤±0.5 dB (0 dBm reference, frequency: 100 MHz, Output A: 0 to +21 dBm) Output level deviation: ≤±1.5 dB (output A: +10 dBm, 100 MHz reference) Step error: ±0.5 dB (Option 10) Output impedance: 50 Ω (when combined with MA4605A: 75 Ω) Connector: BNC-J
Amplitude measurement	Measurement range: ≥120 dB Measurement resolution: 0.001 dB Display scale: 0.01 dB/div to 50 dB/div (1-2-5 sequence) Dynamic accuracy

Level relative to IRG	80 kHz to 100 MHz	10 kHz to 300 MHz
0 to –10 dB	±0.30 dB	±0.30 dB
–10 to –60 dB	±0.05 dB	±0.05 dB
–60 to –70 dB	±0.10 dB	±0.30 dB
–70 to –80 dB	±0.30 dB	±1.00 dB
–80 to –90 dB	±1.20 dB	±4.00 dB
–90 to –100 dB	±4.00 dB	–

Continued on next page

<table>
<tr><td>Phase measurement</td><td>Measurement range: ±180˚
Measurement resolution: 0.001˚
Display scale: 0.01˚ to 50˚ /div (1-2-5 sequence)
Dynamic accuracy
<table>
<tr><th>Level relative to IRG</th><th>80 kHz to 100 MHz</th><th>10 kHz to 300 MHz</th></tr>
<tr><td>0 to –10 dB</td><td>±6.0˚</td><td>±6.0˚</td></tr>
<tr><td>–10 to –60 dB</td><td>±0.3˚</td><td>±0.3˚</td></tr>
<tr><td>–60 to –70 dB</td><td>±0.8˚</td><td>±2.0˚</td></tr>
<tr><td>–70 to –80 dB</td><td>±2.0˚</td><td>±6.0˚</td></tr>
<tr><td>–80 to –90 dB</td><td>±6.0˚</td><td>±20.0˚</td></tr>
<tr><td>–90 to –100 dB</td><td>±20.0˚</td><td>–</td></tr>
</table></td></tr>
<tr><td>Group delay measurement</td><td>DRG: Δθ/(360 x ΔF) *Δθ: phase measurement range; ΔF: frequency span x smoothing aperture (%);
smoothing aperture: 20% to $\left(\frac{2}{\text{number measurement points}}\right)$ x 100%
Measurement resolution: 2.78 x 10^{-5}/ΔF
Display scale: 1 ps/div to 50 ms/div
Dynamic accuracy: Phase measurement accuracy/(360 x aperture frequency)</td></tr>
<tr><td>Calibration, correction</td><td>Calibration types: Frequency response, 1 port, 1 path-2 port, frequency response/isolation calibration, π-NET calibration
Calibration data interpolation:
Measurement frequency, when number of measurement points changed, based on calibration data before change, new calibration data interpolation calculation possible (except at log frequency measurement and 1001 measurement points)
Normalize: X–S
Electrical length calibration
Range: 0 to ±999999.9999999 m, Resolution: 100 nm
Phase offset range: ±180˚</td></tr>
<tr><td>Sweeping</td><td>Frequency sweep: LIN (CENTER/SPAN, START/STOP), LOG (START/STOP)
Level sweep: LIN (START/STOP/STEP)
List sweep: Frequency, level, RBW, the individual setting in the waiting time
Number of measurement points: 11, 21, 51, 101, 251, 501, 1001
Break point: Anywhere between 1 and 1001
Sweep time: 150 µs/point, 38 ms/250 points full sweep (RBW: 20 kHz, normalize calibration, 1 trace)
Setting range: 1 ms to 27.5 h
Sweep functions
Sweep range: Full sweep, part sweep (between markers)
Sweep control: REPEAT/SINGLE, STOP/CONT
Sweep trigger: INT/EXT (RISE, FALL, LEVEL)</td></tr>
<tr><td>Display</td><td>Max. display screens: 2 channels, 4 traces
Display format: LOG MAG (M), PHASE (P), DELAY (D), M/P, M/D, LIN MAG (LIN), LIN/P, LIN/D, REAL (R), IMAG (I), R/I, Z, Z/θ, Q, Z/Q, POLAR, VSWR, IMPD (Z∠θ, Rs + Ls/Cs, Q/D, R + jx), ADMT (Y∠θ, Rp + Lp/Cp, Q/D, G + jB)
Display: 640 x 480 dots, 16.5 cm color LCD</td></tr>
<tr><td>Markers</td><td>Marker functions: NORMAL MKR, Δ MKR, 0 MKR, MKR → MAX, MKR → MIN, MKR → CF, Δ → SPAN, MKR → +PEAK, MKR → –PEAK, MKR TRACK + PEAK, MKR TRACK–PEAK, MKR CHANGE, MKR OFFSET
Setting: Set marker position to frequency or point
Multi-marker: Max. 10 markers for each trace
Filter function: F0, IL, passband (L, R), attenuation band (L, R), Ripple, Q, SF
Resonator function
RESON 1: Fr, Fa, Zr, Za (0 PHASE), Fm, Fn, Zm, Zn (MAX/MIN)
RESON 2: Fs, Fr, Fa, Zr, Za, Q, equivalence constant (R1, L1, C1, C0)</td></tr>
<tr><td>Trace data calculation</td><td>Averaging functions
Method: SUM, MAX, MIN, Count: 1 to 1000
Measurement data memory (max. 1001 points each memory in same format as display format)
Main trace (MT) memory: 2 each (XMEM) for Channel 1 and Channel 2
Calibration S memory: 2 each (SMEM) for Channel 1 and Channel 2
Image memory: 2 each (IMEM) for Channel 1 and Channel 2
Sub-trace (ST): Following calculation between MT and ST (traces calculation of same data as display format)
MT → ST, MT = MT–ST, MT = ST
Limit line: Single or segment (10) limit line, pass/fail evaluation against limit line</td></tr>
<tr><td>Measurement parameters auto-setting</td><td>Receive bandwidth and sweep time: Receive bandwidth set automatically for set sweep time
Automatically set to give minimum sweep time at set receive bandwidth</td></tr>
<tr><td>Auxiliary media</td><td>Saving/recalling data:
Measurement parameters, measured data, calibration data, PTA application programs saved/recalled to/from FD and PMC
Function memory
FD: 100 functions max.
PMC: 100 functions max. (depends on PMC capacity)
Drive and capacity
3.5 inch FDD: 1
Capacity: 720 KB (2DD), 1.44 MB (2HD), MS-DOS format (bmt, text file)
Option 01: PMC (32 to 512 KB)</td></tr>
<tr><td>Printing</td><td>Printing is available using video plotter, printer and FD (bitmap format).</td></tr>
</table>

Continued on next page

Back-panel I/O	Frequency: 5/10 MHz ±10 ppm Level: ≥0.7 Vp-p (AC coupling) Input impedance: 50 Ω (connector: BNC-J) Reference oscillator output Frequency: 10 MHz Level: TTL (DC coupling, connector: BNC-J) External trigger input: TTL Level (connector: BNC-J) GPIB: IEEE488.2 (24-pin Amphenol connector) I/O Port: Parallel interface for PTA (36-pin Amphenol connector) RGB output: For external monitor (15-pin D-SUB connector) Video output: Separate (8-pin DIN) Centronics (Option 02): Parallel interface for printer (25-pin D-SUB connector) RS-232C (Option 02): Serial interface (9-pin D-SUB connector)
External control	Standard: GPIB and PTA; Option 02: RS-232C
Power	100 to 120/200 to 240 Vac (–15%/+10%, 250 Vac max, 100/200 V system auto-switching), 47.5 to 63 Hz, ≤180 VA (max.)
Dimensions and mass	426 (W) x 177 (H) x 451 (D) mm, ≤15 kg
Environmental conditions	Temperature range: 0˚ to +50˚C (operating; FDD: +4 to +50˚C), –20˚ to +60˚C (storage)
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
MS4630B	Network Analyzer
	Standard accessories
	Power cord, 2.6 m: 1 pc
F0013	Fuse, 5 A: 2 pcs
W1534AE	MS4630B operation manual (main frame): 1 copy
W1535AE	MS4630B operation manual (remote control): 1 copy
	Options
MS4630B-01	PMC interface
MS4630B-02	RS-232C, Centronics interface (printer output, external control)
MS4630B-10	Output attenuator (70 dB, mechanical type)
MS4630B-12	3 channel receiver
MS4630B-13	High stability reference oscillator (aging rate: ≤±2 x 10^{-8}/day)
MS4630B-14	3 branch output (for 3 channel receiver)
	Optional accessories
62BF50	Reflection Bridge
62B50	Reflection Bridge
62BF75	Reflection Bridge
62B75	Reflection Bridge
MA2201A	Reflection Bridge
MA2202A	Reflection Bridge
MA2203A	Reflection Bridge
MA2301A	Reflection Bridge
MA2302A	Reflection Bridge
MA2303A	Reflection Bridge
MA2204A	Impedance Probe
MA2403A	Impedance Probe
MA414A	Impedance Measurement Kit (for MA2403A)
MA1506A	π Network (DC to 125 MHz, for resonator measurement)
MA4605A	Impedance Adapter (for MS4630B, 10 Hz to 300 MHz, 50/75 Ω, unbalanced)
P0005	Memory card (32 KB)
P0006	Memory card (64 KB))
P0007	Memory card (128 KB)
P0008	Memory card (256 KB)
P0009	Memory card (512 KB)
MC3305A	PTA Key Board (JIS type)
MC3306A	PTA Key Board (ASCII type)
B0329C	Front cover (1MW4U)
B0333C	Rack mount kit
B0334C	Carrying case (hard type)
	Optional instruments
ME010 series	Test Fixture (PIN, SMD, tip-inductor, etc.)

SCALAR NETWORK ANALYZER
56100A
10 MHz to 110 GHz

For Scalar Analysis

GPIB

The 56100A Scalar Network Analyzer measures insertion loss, insertion gain, or RF power with 76 dB dynamic range. Measure device match as return loss in dB or as SWR. Separate detectors can be used on all four inputs for multiple transmission measurements on duplexers or matched amplifiers.
Transmission and reflection measurements can be viewed simultaneously. Both traces can be scaled independently in dB, dBm, or SWR. Measurement of the ratio of two detector inputs may be applied to either channel for enhancing accuracy or for viewing differences. Built-in calibration allows subtraction of the unwanted transmission frequency response or the average of open/short reflections from either trace. A Volt Mode is available for displaying voltage (with volt mode adapter cable). A 0 to 10 volt sweep ramp output mode is also available.

Features
- Compatible with Anritsu 68/B/C and 69A/B sweep generators
- 10 MHz to 110 GHz
- Four input channels
- Extensive cursor, markers, and limit lines
- Applications functions for improved productivity

REFLECTION BRIDGES

When connected to a reflection bridge, the network analyzers can measure reflection coefficient. This system is used to measure the input and output impedance of telecommunication, video, and audio equipment, and the S-parameter (S_{11} and S_{22}) of two-port networks.

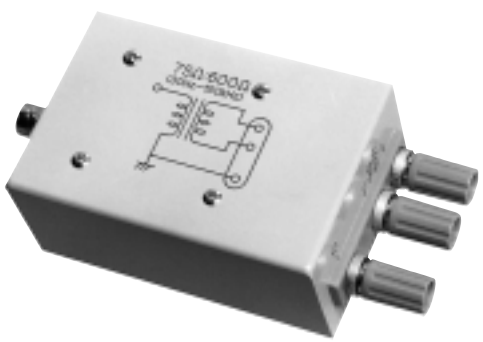
MA2401A

MA2201A

TRANSFORMERS

The transformers are impedance-conversion devices used with the network analyzers to measure the magnitude, phase, delay, level, and spectrum of devices with balanced input and output impedances.

Features
- Input connector is a BNC-type in an unbalanced circuit
- Output connector is a terminal compatible with M-214
- Frequency response: <0.3 dB
- Return loss: >25 dB



Model	Impedance (Ω)		Frequency range
	Input	Output	
MA29A	75	600	30 Hz to 150 kHz
MA29J	50	600	30 Hz to 150 kHz
MA313A	75	75	4 kHz to 2 MHz
MA313J	50	75	4 kHz to 2 MHz
MA314A	75	135	4 kHz to 2 MHz
MA314J	50	135	4 kHz to 2 MHz
MA315A	75	150	4 kHz to 2 MHz
MA315J	50	150	4 kHz to 2 MHz
MA422A1	75	110	10 Hz to 30 kHz

For product ordering information, see pages 4 – 10